western union

Technical Review

VOLUME 21 NO. 2 APRIL 1967

INFO-COM

ISCS

SICOM

HOT/LINE

DIAL-PAK

DOMESTIC SATELLITES

new WU services

Keep Pace with TELECOMMUNICATIONS

Special Issue

DEDICATED TO THE COMMUNICATIONS MANAGER

western union

The purpose of the *Technical Review* is to present technological advances and their applications to communications.

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ERRATA in JANUARY 1967 issue

On pg 23 the complete list of operations comprising the I S & S Department relocated in Mahwah, N. J. should have included:

Commercial Projects Operation.

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APRIL 1967

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Our Message to the Public, Business and Government

WESTERN UNION IS NOW CARRYING OUT A NATIONWIDE MODERNIZATION PROGRAM, BASED ON THE LATEST DEVELOPMENTS IN COMMUNICATIONS AND COMPUTER TECHNOLOGY, THAT WILL EXPAND OUR FACILITIES, IMPROVE SERVICE, AND BROADEN THE RANGE OF COMMUNICATION AND INFORMATION SERVICES OFFERED TO CUSTOMERS OF ALL KINDS—THE PUBLIC, BUSINESS AND GOVERNMENT.

COMPUTERS ARE AN ESSENTIAL PART OF OUR PROGRAM TO INTEGRATE THE PUBLIC MESSAGE SYSTEM WITH THE TELEX NETWORK INTO A SINGLE, MODERN SYSTEM WITH A GREATLY ENLARGED COMMUNICATION/INFORMATION CAPABILITY.

OUR FIRST COMPUTER CENTER IN NEW YORK IS NOW IN OPERATION AND ADDITIONAL COMPUTER CENTERS ARE NOW BEING COMPLETED IN CHICAGO, SAN FRANCISCO AND ATLANTA. THE SECOND PHASE OF OUR MODERNIZATION PROGRAM CALLS FOR THE INSTALLATION OF LARGE, MULTIPLE-ACCESS COMPUTERS OF ADVANCED DESIGN AT KEY LOCATIONS COAST-TO-COAST LINKED BY HIGH-CAPACITY, BROADBAND CHANNELS. WE WILL THEN BE EQUIPPED TO FUNCTION AS A NATIONAL COMMUNICATIONS/INFORMATION SYSTEM PROVIDING THE PUBLIC, INDUSTRY AND GOVERNMENT WITH NEW SHARED-USE, COMPUTER-OPERATED SERVICES OF MANY AND VARIED TYPES.

WESTERN UNION'S AIM FOR THE PRESENT AND FUTURE IS TO DEVELOP AND PROVIDE THE SERVICES TO MEET THE PRESENT AND FUTURE NEEDS OF OUR CUSTOMERS, LARGE AND SMALL.

WE EXPECT THAT MANY LARGE CUSTOMERS WILL CONTINUE TO OPERATE THEIR OWN COMPUTERIZED PRIVATE SYSTEMS. OTHERS WILL TURN TO WESTERN UNION'S NEW, COMPUTERIZED NATIONAL SYSTEM TO MEET THEIR NEEDS. OUR AIM IS TO PROVIDE FOR ALL NECESSARY DATA AND COMMUNICATIONS REQUIREMENTS, INCLUDING THE PROCESSING OF DATA, FORWARDING OF INFORMATION, AND RETRIEVAL FROM LARGE DATA BANKS.

PRESENT AND FUTURE ADVANCES IN COMPUTER AND COMMUNICATIONS TECHNOLOGY, INCLUDING SATELLITES, ARE DESTINED TO GIVE MODERN COMMUNICATIONS A NEW MASTERY OF INFORMATION ACQUISITION, PROCESSING AND DISTRIBUTION ON BOTH A NATIONAL AND GLOBAL SCALE.

NEVER BEFORE IN HISTORY HAS THE ROLE OF THE COMMUNICATOR HELD SUCH PROSPECT FOR GREATER IMPORTANCE IN CHARTING NEW PATHWAYS FOR CONTINUED GROWTH AND PROGRESS IN THE FIELD OF TELECOMMUNICATIONS.

AS A RESULT OF THE RAPID ADVANCES IN COMMUNICATIONS AND COMPUTER TECHNOLOGY, COMMUNICATORS EVERYWHERE, IN BUSINESS AND GOVERNMENT, ARE BEING CALLED UPON FOR INFORMATION AND DECISIONS THAT WILL AFFECT THE DESIGN AND OPERATION OF THEIR FUTURE COMMUNICATION SYSTEMS.

MANY ARE NOW BUSY ANALYZING THE EFFICIENCY AND CAPABILITIES OF THEIR PRESENT NETWORKS AND DEVELOPING PLANS THAT, HOPEFULLY, WILL INSURE THE BEST POSSIBLE SELECTION AND USE OF NEW EQUIPMENT AND CIRCUITRY, INCLUDING COMPUTERS OF ADVANCED DESIGN AND RELATED HARDWARE, TO MEET THE EXPANDING, COMPLEX COMMUNICATION NEEDS OF TODAY AND TOMORROW. THEY ARE ALSO GIVING CAREFUL STUDY TO NEW SYSTEMS AND SERVICES UNDER DEVELOPMENT BY THE COMMON CARRIERS.

THE PLANNING AND DECISION-MAKING RESPONSIBILITIES OF TODAY'S COM- [illegible] OF THE ENTIRE COMMUNICATIONS FIELD, RECORD, VOICE AND VIDEO—WHAT IS HAPPENING AND WHAT IS GOING TO HAPPEN. FEW COMMUNICATORS ARE FULLY AWARE OF ALL THE IMPORTANT CHANGES AND DEVELOPMENTS UNDER WAY. AND ADDING TO THE PROBLEM IS THE REASONABLE CERTAINTY THAT HALF OF WHAT THE EXPERTS KNOW TODAY WILL BECOME OBSOLETE IN THE NEXT TEN YEARS AND HALF OF WHAT THEY NEED TO KNOW IS STILL UNDISCOVERED. YET, DESPITE THE [illegible] KNOW NOW AS MUCH AS CAN BE KNOWN SO THAT PROMPT, ACCURATE, DEPENDABLE DECISIONS MAY BE MADE.

[illegible] DIFFERENT SERVICES TO MEET THE IMMEDIATE AND FUTURE NEEDS OF ITS CUS- [illegible] OF TECHNICAL REVIEW AND OTHERS, OF EQUAL IMPORTANCE, ARE UNDER DEVELOPMENT FOR LATER ANNOUNCEMENT.

WORKING ON NEW SYSTEMS AND INFORMATION SERVICES ARE SOME [illegible] PLANNING AND MARKETING SPECIALISTS, COMMUNICATION AND INFORMATION SYSTEMS DESIGNERS, PROGRAMMERS AND ENGINEERING PERSONNEL AT OUR NEW INFORMATION SYSTEMS COMPUTER LABORATORY IN MAHWAH, NEW JERSEY.

FIRST OF ITS KIND, THE MAHWAH LABORATORY IS SERVING AS A PROVING GROUND TO DEVELOP AND EVALUATE, UNDER ACTUAL OPERATING CONDITIONS, COMPUTER-ASSOCIATED INFORMATION SYSTEMS LEASED TO BUSINESS AND INDUSTRY. THIS LABORATORY IS ALSO BEING USED TO DEVELOP AND PERFECT NEW COMMUNICATION AND INFORMATION SERVICES FOR USE IN WESTERN UNION'S OWN TELECOMMUNICATION SERVICES FOR THE GENERAL PUBLIC AND OTHER USERS.

AS A NEW IDEA FACTORY, OUR LABORATORY IS MOVING AHEAD TO SOLVE TOMORROW'S COMMUNICATION PROBLEMS TODAY. WE ALSO SEE IT AS AN AD- [illegible] EXPERT ADVICE AND ASSISTANCE IN ANALYZING THEIR SPECIAL NEEDS AND DEVELOPING THE RIGHT SOLUTIONS.

NO MATTER HOW DIFFICULT OR DEMANDING THE REQUIREMENTS MAY BE, [illegible] —THE RIGHT COMMUNICATION SERVICES, OR SERVICES, AT THE RIGHT TIME.

R. W. Hodgers, Jr.

western union

april 1967

Technical Review

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The cover design symbolizes the increasing number of developments in Western Union's modernization program.

Printed in U.S.A.

ISCS*

information service computer system

expands Western Union services

John A. Hunt

In recognition of its vital role as a leading telecommunication company, Western Union has designed and is now implementing the Information Service Computer System (ISCS*). This system will add versatility to Western Union's services and will establish a base from which a broad range of information/communications services, to large and small users, will be possible on demand from these users.

A prototype Information Service Computer Center, opened in New York on February 16, 1966, serves more than 5,500 Telex subscribers in the eastern United States. The services it offers, called Automatic Computer Telex Services, consists of the following:

(1) A message service to Telex stations anywhere in North America (except Alaska);

(2) A message service to those domestic TWX stations having unattended operation and equipped with unique answer-back devices;

(3) A multiple address service whereby a common message text can be transmitted to as many as 100 Telex or TWX stations, or a combination of both.

The Center is also providing an on-line data retrieval service called Legal Citation Service. This service instantly provides a list of precedent setting case citations to a subscribing attorney station in response to a coded inquiry.

The capabilities of this Center will be expanded and integrated into the ISCS* Phase I network.

Phase I Service

(a) A major objective of the ISCS* Phase I Service is to expand the Automatic Computer Telex Services nationwide, and thus broaden their scope, and to simplify the procedures that the user must follow.

An additional Automatic Computer Telex Service has been designed, to increase the utility of the user's terminal by providing it with automatic access to Western Union's Public Message System, by means of the Telex system. This new service will permit a Telex subscriber to file messages via the computer system, for subsequent delivery to any point within the continental United States (except Alaska) by the Public Message System. Constraints upon the user will be minimized since the only routing information required

* Western Union Trademark

consists of merely the name and address of the receiver. The system will analyze the English words, appearing in the address portion of the message, to determine the routing.

Multiple address messages may contain any combination of addresses. A user may file any number of unique single address messages or a single multiple address message during any connection.

(b) The second objective of the ISCS Phase I Service is to provide a shared-message switching service, whereby a subscriber may exchange traffic among stations of his own network and relay traffic to other services.

Subscriber stations (selected by the customer) will consist of a combination of 100 wpm U.S. ASCII terminals, which are either directly connected or share an input circuit depending upon the traffic load of the station. Terminals having light traffic loads will be equipped with 66 wpm terminals operating in Baudot code.

Service features will include mnemonic routing, 2 levels of priority, group codes, alternate routing capability, network control stations, on-line and off-line traffic reports, etc. This service, called Info-COM, is described in detail in another article in this issue of the Technical Review.

System Approach

Figure 1 is a block diagram which shows the interconnections of the ISCS, Phase I with other major systems. Each of the networks, Telex, Info-Com, TWX and PMS will continue to operate as autonomus systems with inter-system communications being provided by the ISCS.

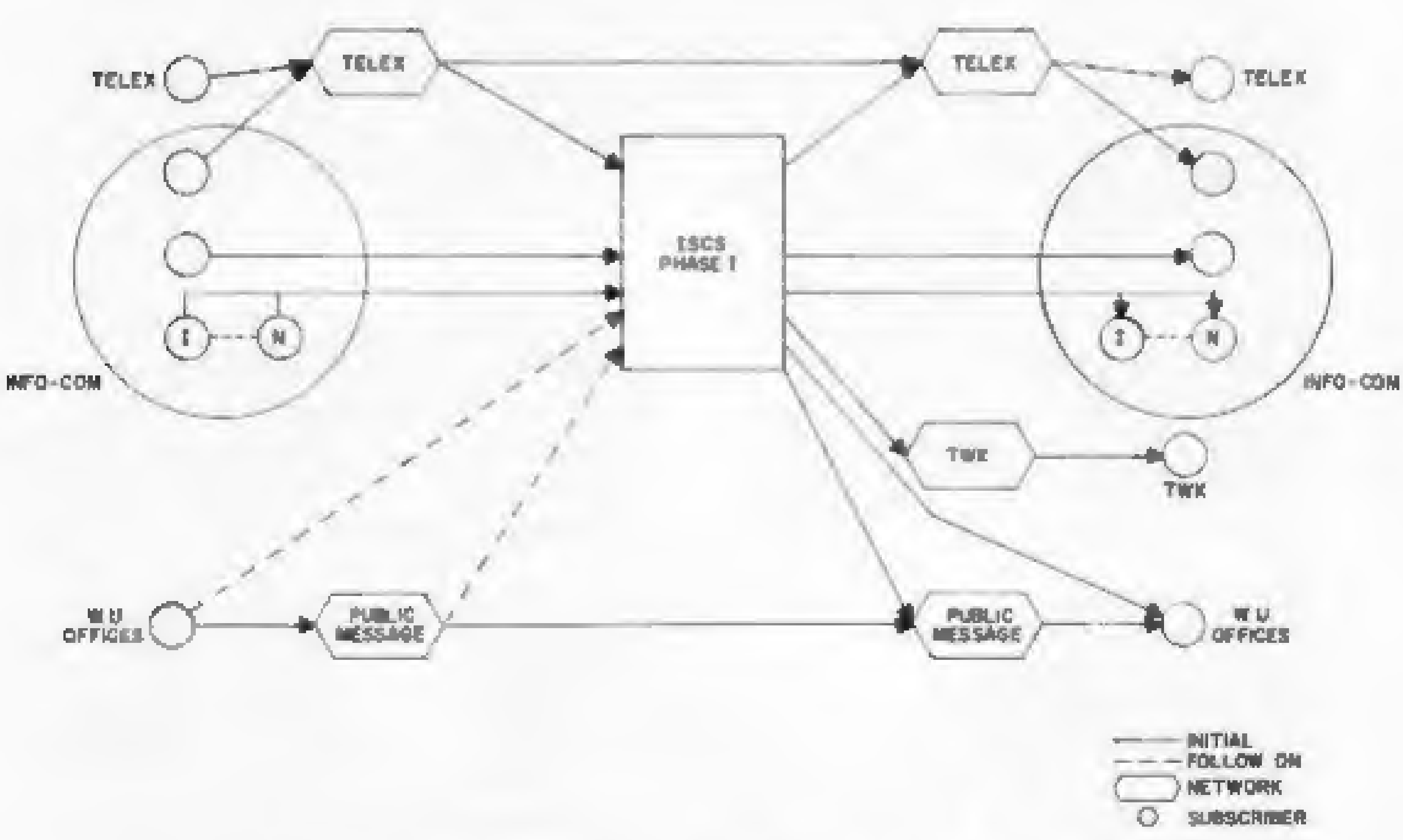

Figure 1 — Interconnections of ISCS with Telex, TWX, & PMS

Figure 2 illustrates the ISCS Phase I configuration. The Processing Center (PC) is a computer with a full line of peripherals. It performs all of the logical functions associated with the transaction, i.e., message validations, storage, routing, journalling, billing, etc.

The functions labeled CC, the Communications Centers, consist of a computer main frame and communications subsystems necessary to interface with the communications lines.

The CC performs all of the repetitive communications functions associated with terminal servicing and line inter-play. The CC also responds to message routing indicators to direct the input message to the proper PC.

All the CCs are interconnected by 2400 baud circuits and are also connected to each of the various terminal systems as shown in the case for Atlanta. Each PC is connected to its co-located CC by means of a core-to-core coupler.

The system is essentially modular in design; additional CCs or PCs can be easily added as the need arises.

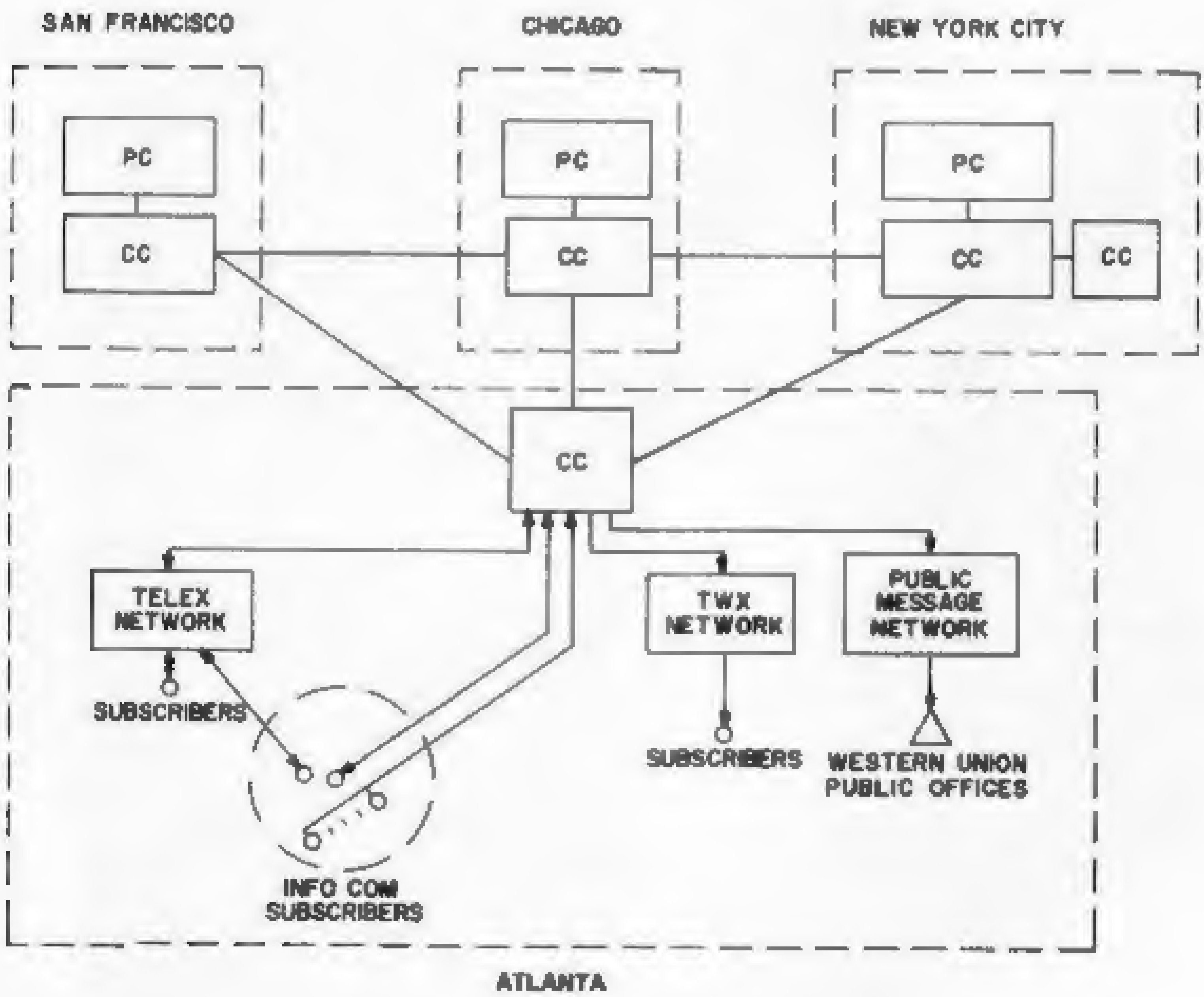

Figure 2 — ISCS Phase I Configuration

Hardware

Figure 3 is illustrates the hardware configuration in a typical location.

Each Processing Center contains.

- Univac 418-II Computer equipped with 65, 536 computer words (18 bit) of core memory having a memory reaction time of 2 microseconds.
- Univac VI-C magnetic tape sub-system. Comprising the Magnetic tape Control and the 6 tape stations. Write Density 200, 556, or 800 characters per inch. Transfer rate 27, 71, or 102 KC.
- Univac FH 330 Drum system with a capacity of 262,144 computer words (18 bit) having an average access time of 8 5 milliseconds.
- Univac Fastrand II mass storage drum with a capacity of 44,040, 192 computer words (18 bit) having an average access time of 92 milliseconds.
- Univac 1004-IA printer/card reader which operates at 200 lines/cards per minute.
- Inter-Computer Synchronizer having a data transfer rate of 10 000 computer words (18 bit) per second.
- Console typewriter and alarm.
- Intercept Positions Teletype Model 35 ASR s operating at 110 Baud in 8 level U.S. ASCII code
- Communications Log Printers Kleinschmidt Model 311 operating at 300 Baud in 8 level U.S. ASCII code

For reliability purposes all of the above equipment is duplicated in a fall back system at each site. An arrangement of transfer switches permits any of the peripheral devices to be easily connected to the operating computer

Each Communications Center Contains.

- Univac 418 II Computer equipped with 32,768 computer words (18 bit) of core memory having a memory reaction time of 2 microseconds.
- Console typewriter and alarm
- Paper tape sub-system
- Five communications multiplexors each capable of serving a variety of full duplex lines operating at speeds up to 2,400 bit/second.

The communications centers interface with the following types of lines.

• Telex	50 baud	5 Level Baudot Code	Asynchronous
• PMS	56.7 baud	5 Level Baudot Code	Asynchronous
• Info COM	110 baud	8 Level ASCII Code	Asynchronous
• TWX	110 baud	8 Level ASCII Code	Asynchronous
• Intercept Positions	110 baud	8 Level ASCII Code	Asynchronous
• Communications Log Printer	300 baud	8 Level ASCII Code	Asynchronous
• CC-CC	2,400 baud	8 Level ASCII Code	Synchronous

The various lines are distributed among the multiplexers to guard against the loss of a "service" in case of the failure of a multiplexer

At a center which contains both a PC and a CC, the computer mainframe of the fall-back PC may be utilized for the CC function if necessary. At Atlanta, a duplicate computer mainframe will be provided to increase reliability.

Message Format

The ISCS message format has been designed to minimize the constraints upon the user, while maintaining the proper controls to insure message integrity

Every message must contain the following elements.

(a) Start of Message ZCZC

(b) Network Designator

The network designator indicates the type of delivery to be made i.e.

TLX	Telex System
TWX	TWX System
ICS	Info-COM Terminal
PMS	Public Message System
GCS	Group Code for any combination of above

The routing information associated with each of the above is as follows.

TLX	Dial Number and answer-back
TWX	Dial Number and answer-back
ICS	Mnemonic Routing Code
PMS	Name and address of recipient
GCS	Mnemonic Routing Code

(c) End of Routing (<≡BT<≡)

(d) End of Message (Text)

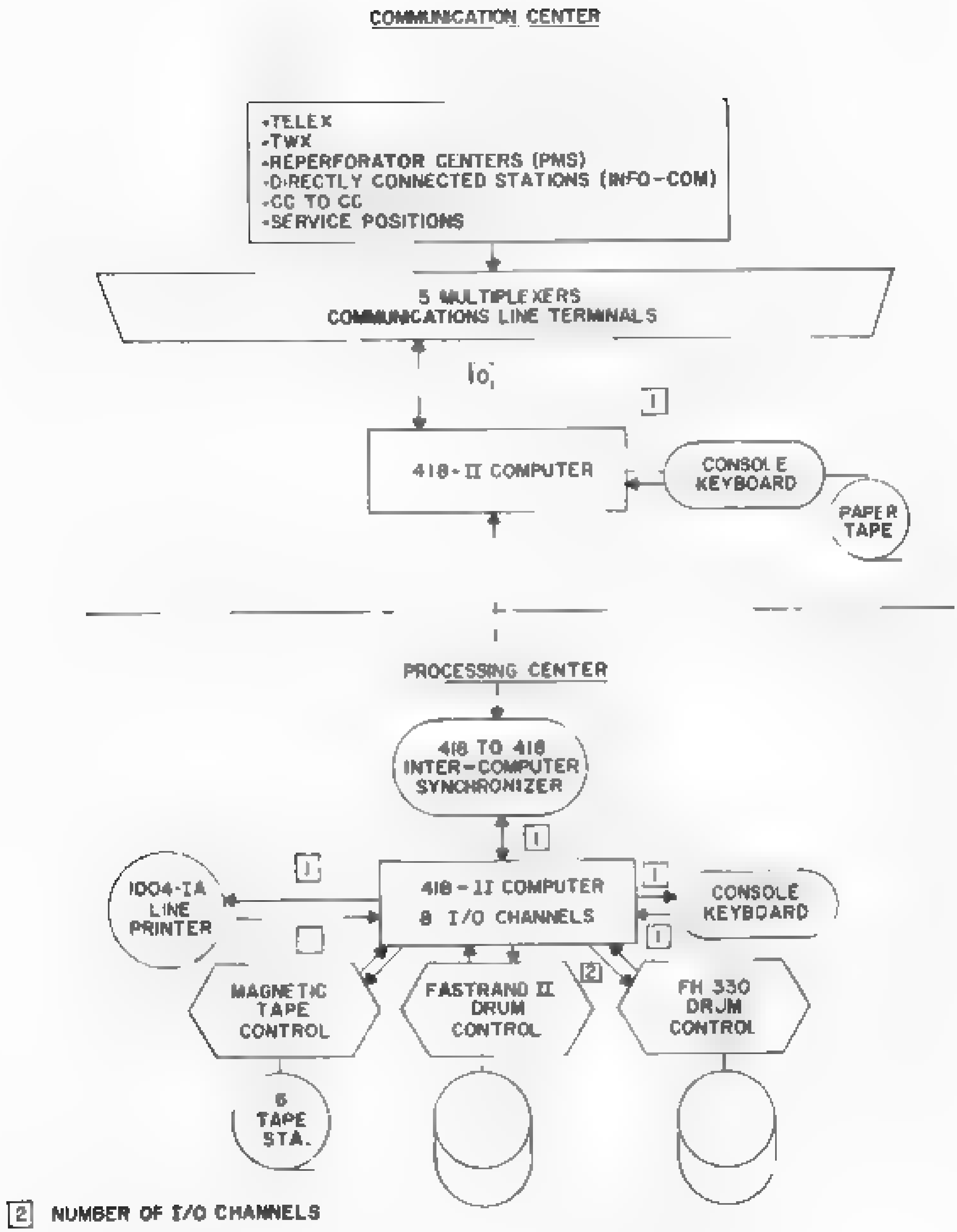

Figure 3 — Hardware Configurations for a Typical Installation

The fo iowing are examples of single and multiple address messages.

A—Single Address

```
         RELAY TO TELEX
Line 1   ZCZC 001 COLLECT<≡
Line 2   TLX 34436 XEROX SFO<≡
Line 3   JOHN JONES ROOM 303<≡
Line 4   BT<
Line 5   TEXT & SIGNATURE<≡
Line 6   NNNN<≡

         RELAY TO PUBLIC MESSAGE SYSTEM
Line 1   ZCZC 002 PO ALBANY NY<≡
Line 2   PMS R. ROE<≡
Line 3   117 S. WOODLAND AVE CLEVELAND OHIO<≡
Line 4   BT<≡
Line 5   TEXT & SIGNATURE<≡
Line 6   NNNN<≡
```

Notes.

1. Underlined fields are optional
2. Any number of single address messages may be sent during one connection. If more than one message is sent during a connection, all messages after the first must contain message numbers.
3. The following may not appear in the text: ZCZC, NNNN, Figs. D, <≡BT<≡, EOA, Xoff, WRU

B—Multiple Address

```
Line  1   ZCZC MA 001<≡
Line  2   TLX 23461 US NEWS PARA<≡
Line  3   JOHN JONES ROOM 202<≡
Line  4   BT<≡
Line  5   TEXT & SIGNATURE
Line  6   NNNN<
Line  7   ZCZC 002 PO SYRACUSE, NY<≡
Line  8   PMS J. DOE<≡
Line  9   447 S. MAIN ST DENVER COLO<≡
Line 10   BT<≡
Line 11   ZCZC 003<≡
Line 12   TWX 2125774520 GEN INST<≡
Line 13   BT<≡
Line 14   NNNN<≡
```

Notes:

1. Multiple Address indicator, MA follows the ZCZC sequence.
2. Lines 2 5 are identical to the single address format
3. NNNN of Line 6 shall serve as EOT.
4. Information similar to that shown in Lines 7 10 is entered for each subsequent addresses.
5. NNNN of Line 14 shall serve as an end of message sequence.
6. Only one multiple address message may be transmitted.
7. Underlined fields are optional

Interplay With User

Input

A subscriber may gain access to the ISCS by dialing a special Telex number. When the system has recognized the connection it will initiate the exchange of answer backs as follows:

WU ISCS	09/01/66	01374673007	WRU
Computer Center Identification	Date	ISCS Connection Number	Request of Calling Subscriber's Answer-Back

The calling station automatically responds to the WRU sequence and transmits its answer-back to the system. Following the exchange of answer-backs, the user proceeds with his transmission, adhering to the message format previously described

A user may transmit any number of single address messages during a given connection or he may transmit one multiple address message.

The system will acknowledge the receipt of messages, or addresses, In the case of a multiple address message, on an individual basis at the end of each period of transmission. An example of such a message follows.

ACCEPTED WU ISCS NUMBER(S)
001
002

If the message contains a format error, the system will respond with an acknowledgement message, notifying the user of the type of error detected. The acknowledgement message would appear as follows:

UNABLE TO PROCESS NUMBER(S)
005 INVALID NUMBER
PLEASE CORRECT AND RESEND

This input interplay is slightly modified for the Class A or B directly-connected Info-COM terminals; however, the same basic functions are performed

Output

When the system delivers traffic directly to a subscriber terminal (Telex, TWX, Info-COM), the delivery is preceded by a comparison of answer-backs to verify the identity of the terminal. If the answer-back comparison is valid, the system transmits the following:

VIA WU INFO SVC COMPUTER

$$\underbrace{\text{NY}}_{\text{PC Identity}} \quad \underbrace{\text{123}}_{\text{Julian Date}} \quad \underbrace{\text{AA}}_{\text{CC Identity}} \quad \underbrace{\text{457324}}_{\text{Trunk Identity Sequence Number}} \quad \underbrace{\text{09/01/67}}_{\text{Date}}$$

Following the delivery of the message, another answer-back comparison is made to verify that the terminal is still operable.

Message Processing

Figure 4 is a simplified block diagram of the functions performed in the processing of a message.

The basic interplay with the communication line is performed by the CC. The CC recognizes and reacts to the signals emmanating from the communications line. Upon recognizing the start of an incoming call, the CC assigns a connection number, incorporates it into an identifying message, and transmits this message to the calling terminal. The connection number is also stored for later shipment to the PC for message identification purposes. At the end of the identifying message, the CC transmits the character sequence "Figs. D" which causes the answer-back of the terminal to be activated. As the answer-back is being received, the CC checks for a valid beginning and end and the range of characters.

Following the exchange of answer-backs, the subscriber begins sending his message. The CC accumulates the data, translates it into a common code (ASCII) and checks for a valid start of message. Upon the detection of a valid start of message, the CC requests the appropriate PC for a processing position. If the PC responds with a "processing slot," the CC continues receiving, translating, storing, and relaying the incoming message data to the PC upon the recognition of significant character sequences or the receipt of a predetermined number of characters. As the special control sequences (SOM, BT, NNNN) are recognized by the CC, the time of receipt is recorded and sent to the PC for permanent storage.

As the PC receives the incoming data, various validity checks are made to check for "apparent accuracy" (proper length and types of fields) of the address information. The complete message is stored on magnetic tape and on the mass storage drum.

When the address is validated and the message text is complete, the message is put on an active queue for delivery. However, if the message is destined for the Public Message System, it is passed to the city/state routine for further validation, routing, and queueing. The queue tables in core contain a minimum amount of information. Additional information relating to the handling of the message is kept in a special information packet on the 330 Drum.

Following the validation, the message acknowledgement process constructs an acknowledgement message which is sent to the originator when transmission has stopped.

If the message validation process detects an error that can be corrected, the message is accepted and queued for delivery of the header to a manual intercept position where appropriate action can be taken. If not, it is rejected and an Error Journal entry is made.

The sequence of events associated with an incoming message from an Info-COM terminal differ, but essentially the same basic functions are performed.

Initiation of the delivery routine takes place at the PC. The PC cyclically scans each of the output queues and selects a message for delivery. When a message is selected, the control information relating to its delivery is retrieved from the 330 Drum and a request for an appropriate output communication line is constructed and transmitted to the CC. The routing information, including the answer-back of the destination terminal, is included in this request.

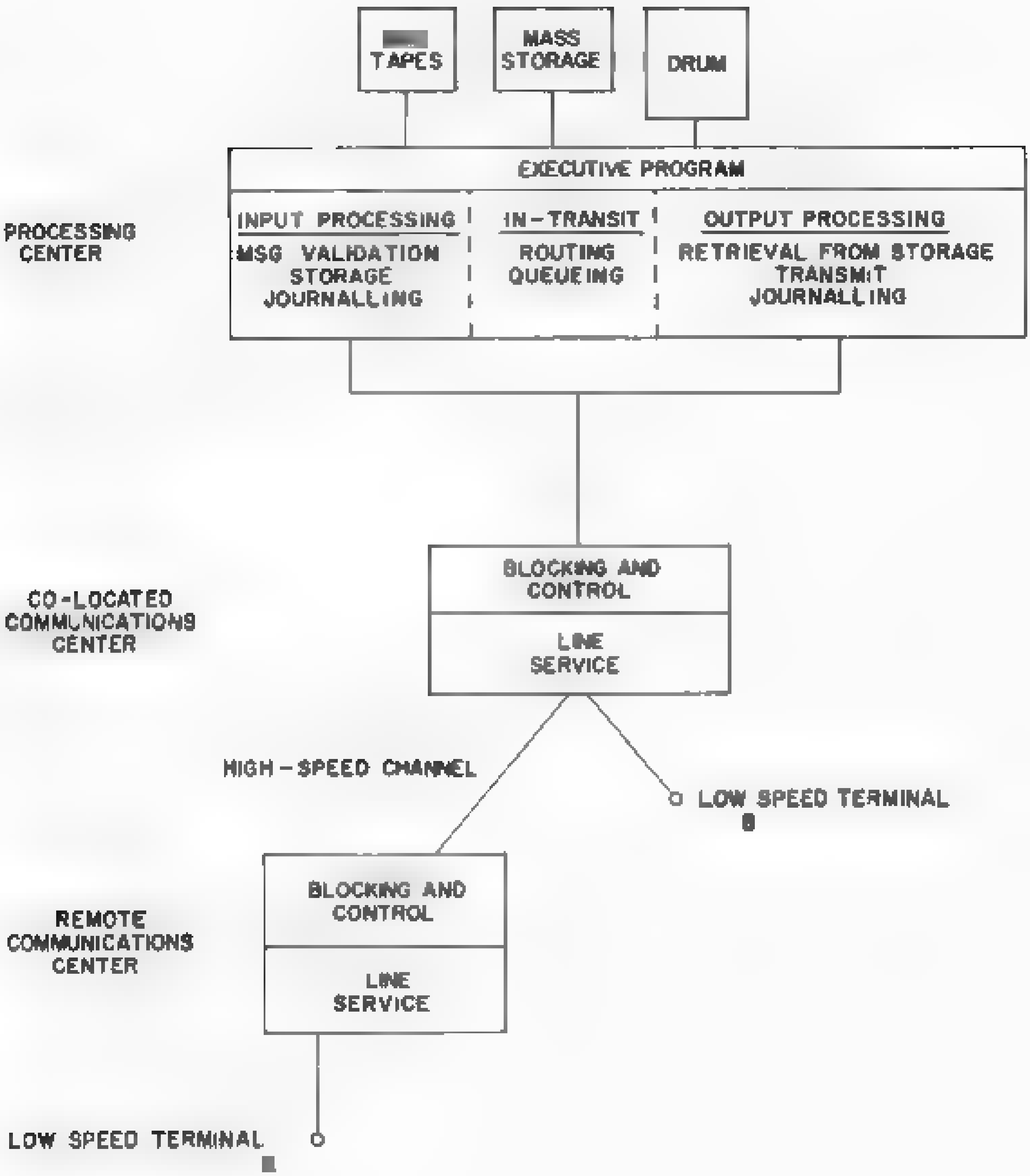

Figure 4 — Block Diagram of Message Processing

The serving CC selects the desired communication line and performs the line service action, i.e. (dials into Telex, TWX, polls Info COM terminal). When the CC has determined that the destination station is ready, it requests the answer back of the station. The response to the request is compared to the data contained in the request sent by the PC. If a valid comparison is made, the PC is notified that the terminal is ready to receive the message. Transmission to the Public Message system is on a direct line basis with no line interplay or answer-back exchange. Message protection is provided by sequential number checking at the reperforator office.

The PC then retrieves the message from the mass storage drum and forwards it in blocks to the CC for delivery at a rate consistent with the terminal being served. Code and speed conversion take place at the CC.

Prior to delivery of the first block of message data to the terminal, the CC constructs a pre-message header, which includes a unique CC assigned connection number, and delivers this to the terminal. Following this, the delivery of the message begins.

When the CC recognizes that it has sent the end of message sequence (NNNN), it again requests and compares the answer-back of the terminal to ensure that it is still operable. The CC then disconnects and sends the control information, including the connection number, back to the PC for permanent storage.

All records of the transactions are maintained at the PC in a permanent file on magnetic tape. The Reference Journal contains a complete copy of the message as entered by the subscriber. The Input Journal contains control information relating to the address portion. The Output Journal contains control information relating to the delivery. The Error Journal contains information relating to all error conditions encountered.

Figure 5 illustrates the routing of a message through the system.

Assume a Telex subscriber in Los Angeles is sending a message, A, to a non subscriber in Baltimore and a message

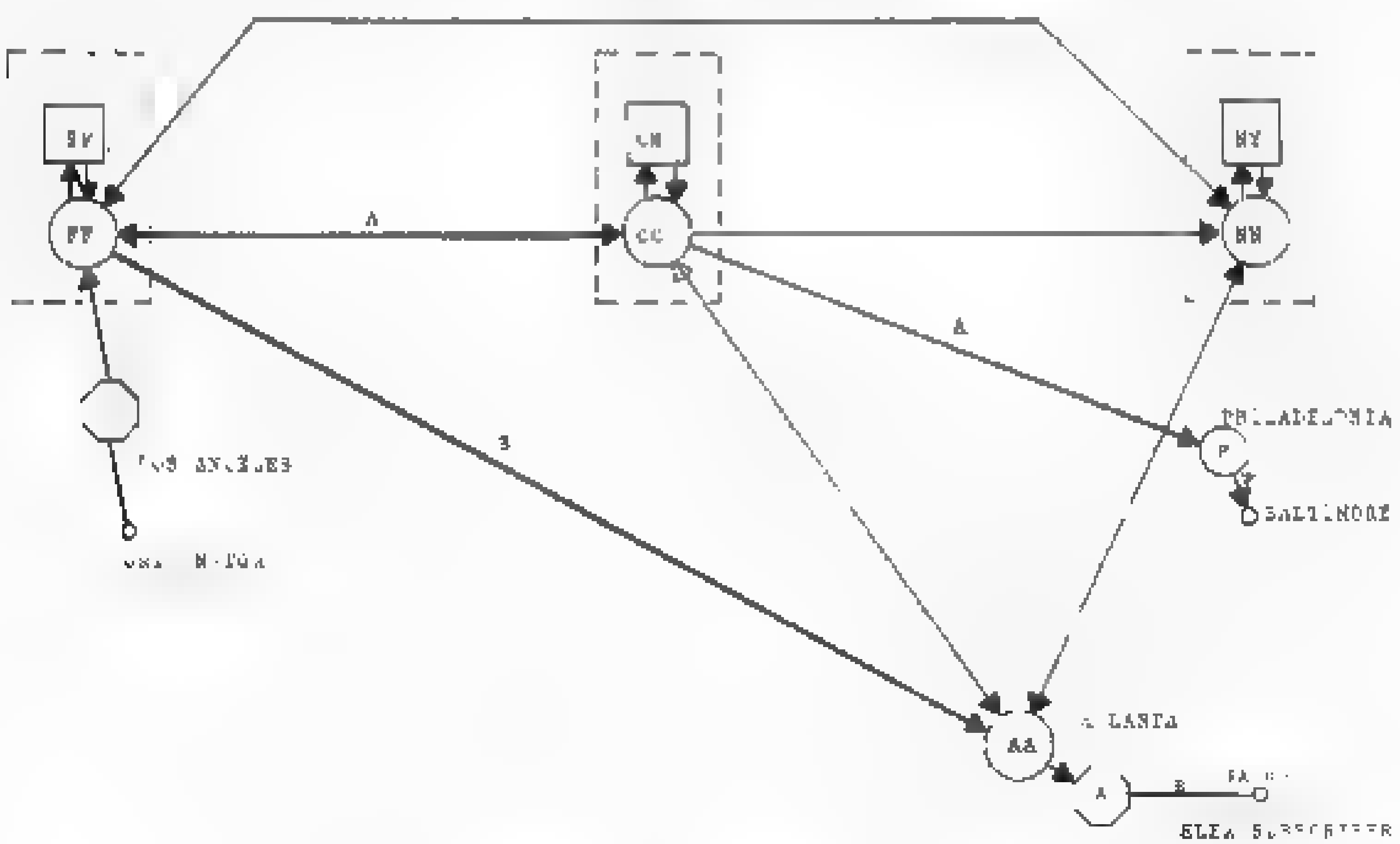

Figure 5 — Routing of Two Messages Through the ISCS

"B" to a Telex subscriber in Jacksonville, Florida.

In both cases, the sender obtains a connection to the Communications Center at San Francisco designated FF, via the Telex system and enters his message. FF forwards the messages to the Processing Center designated as SF in San Francisco.

To send the message "A" to Baltimore (Route A on the diagram), SF determines, as a result of the city/state analysis, that the destination is served through the Philadelphia reperforator office, which in turn is served from the Communications Center CC at Chicago.

In the case of the delivery of message "B" to Jacksonville, (Route B on the diagram) SF determines that the logical point of entry into the Telex system is Atlanta. A route is established over the high speed channel to AA the Communications Center in Atlanta and the message is delivered via the Atlanta Telex exchange.

The illustrations in Figure 5 emphasize the utility of the Communication Center network of high speed circuits in minimizing congestion in each of the various sub systems.

Future Growth

The Information Services Computer System will play the dominant role in integrating all of Western Union's services and systems into one highly flexible record communication/information system. Longer range plans include the expansion of the Communications Center network and the installation of large capacity "third generation" computers at key locations. The system will make available, to most users, a total range of communication/information services through the use of a single terminal.

* * * *

Reference

1. Information Services Computer Center, S. Wernikoff, Western Union Technical Review, Vol. 20, No. 3, July 1966

JOHN A. HUNT, Director—Systems Requirements, in the Information Systems and Services Department has been concerned with various system improvement programs.

He joined Western Union in 1955 and has played a major role in the planning of various system improvements for such programs as Telex, Broadband Switching, etc.

He received his degree in Engineering Administration in 1952 from the University of Mississippi and served three years with the U.S. Navy as an Officer.

Info-COM *

a new computer-directed information communication service

During the latter part of 1967, Western Union will introduce a new communications service called Info-COM.* This service is made possible by the store-and-forward message communications system which uses the new WU nationwide low speed and high-speed message network and the three computer processing centers located in San Francisco, Chicago, and New York.

Henry P. Bechtold

INFO-COM* has been developed to meet an increasing need by industry for computer-operated message switching, data collection and similar services on a shared-use basis.[1] Computers in the Company's new computer centers will be used to offer a variety of services to meet individual customer requirements as to message and data volume, speed of transmission, terminal equipment, and control of operating costs.

Info-COM service is a network of many private systems, each allocated to a specific customer. The basic systems concept is a network of tributary stations interconnecting through the Western Union low and high speed communications network to central computer processing centers which perform the message switching and processing functions. This interconnection of the communications network and the processing centers called ISCS* is described in another paper, in this issue; therefore, it will not be covered here in detail. However, to assist in a better understanding of the operation of the Info-Communications Service, it is necessary to review the ISCS in broad concept. A block diagram of ISCS is shown in Figure 1

*Western Union Trademark

The ISCS network is made up of the following four levels.

1. Computer Switching and Processing Centers.
2. High Speed communications network which interconnects all communications centers collocated with the processing centers.
3. High-speed communication networks which are interconnected to computer switching centers which are not collocated with the processing centers, but serve nationwide communities.
4. Low speed access lines which provide tributary station access to the high speed communications network

To demonstrate the message flow within the system and the functions of the various components of the system, let us consider two customer networks on the system, customer A and customer B. In both instances messages originate in Los Angeles and are destined for delivery in Washington, D. C. In the case of the "A" network, the processing center designated within the system to handle this traffic is in San Francisco, while in the case of the "B" network, the Chicago processing center is designated to handle the "B" traffic.

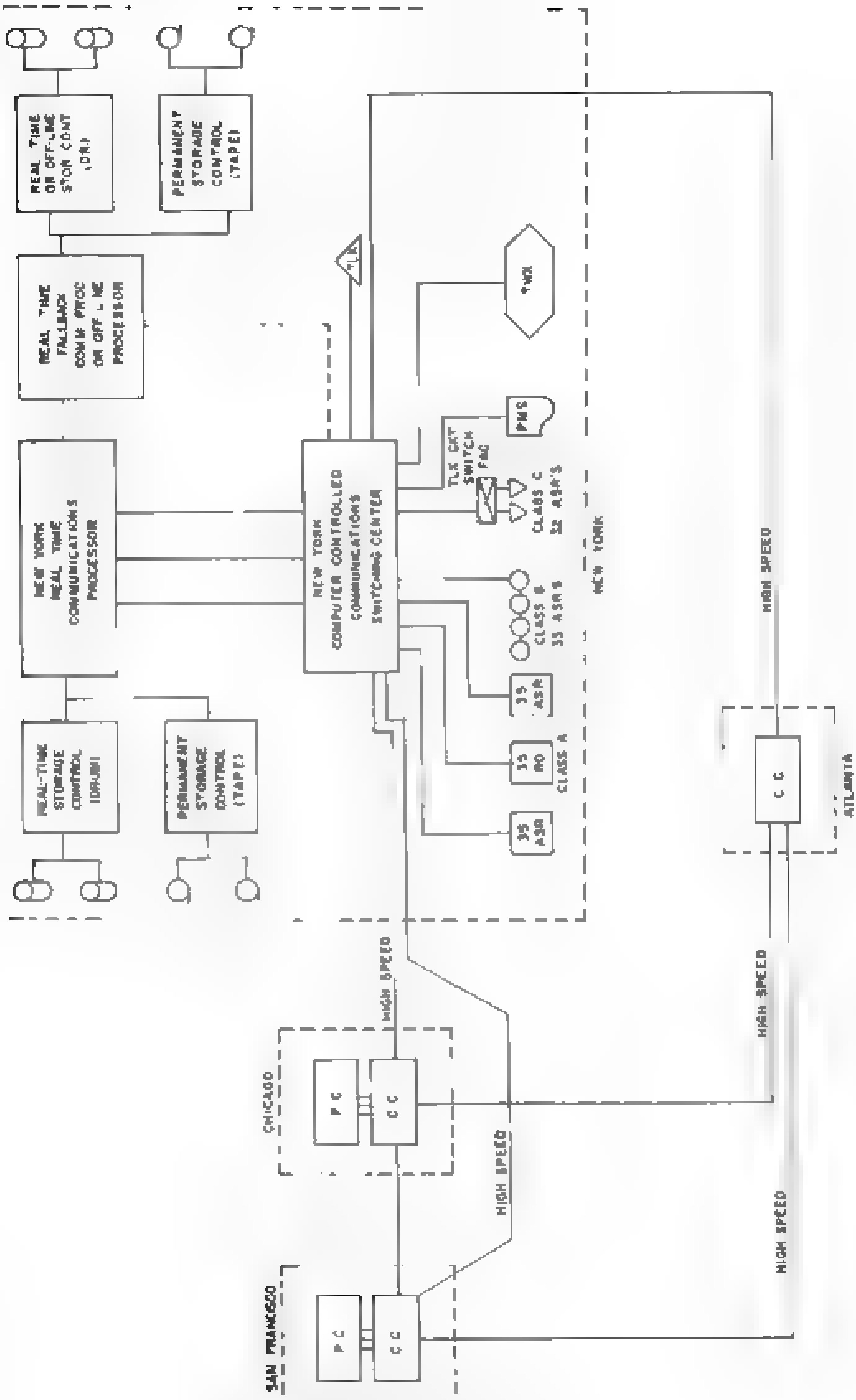

Figure 1—ISCS Network

Figure 2 demonstrates the message flow within the ISCS system. The message is transmitted over the low speed access line into the high speed network via the communications center (CC). The communications center is a computer which identifies the originator and associates it with a specific network, then routes this message via the high speed network to the processing center (PC) designated within the system to handle the traffic of this specific customer. The processing center performs its functions and then requests access to the point of delivery via the high speed communications network which, in turn, delivers the message to its destination via a communication center (CC). Where a message cannot be delivered to its destination, due to terminal busy conditions, it is retained in "queue," for that particular station at the processing center, until delivery is possible.

Info-COM Service

The Info-COM service, has been structured to be operationally and economically balanced to serve two categories of out stations, heavily loaded and lightly loaded. The heavily loaded, Class A, trib station will be provided on a dedicated circuit basis directly into the Western Union high speed communications network to the switching computer. The lightly loaded or Class B customer trib station will be provided on "shared trunk facilities" to the communications center.

The Info-COM system is designed to operate initially at the input and output terminals at 100 wpm using the ASCII as a standard code. Figure 3 is a typical customer network configuration showing various types of Info-COM outstations and their access to other Western Union services as provided by Info-COM. Higher

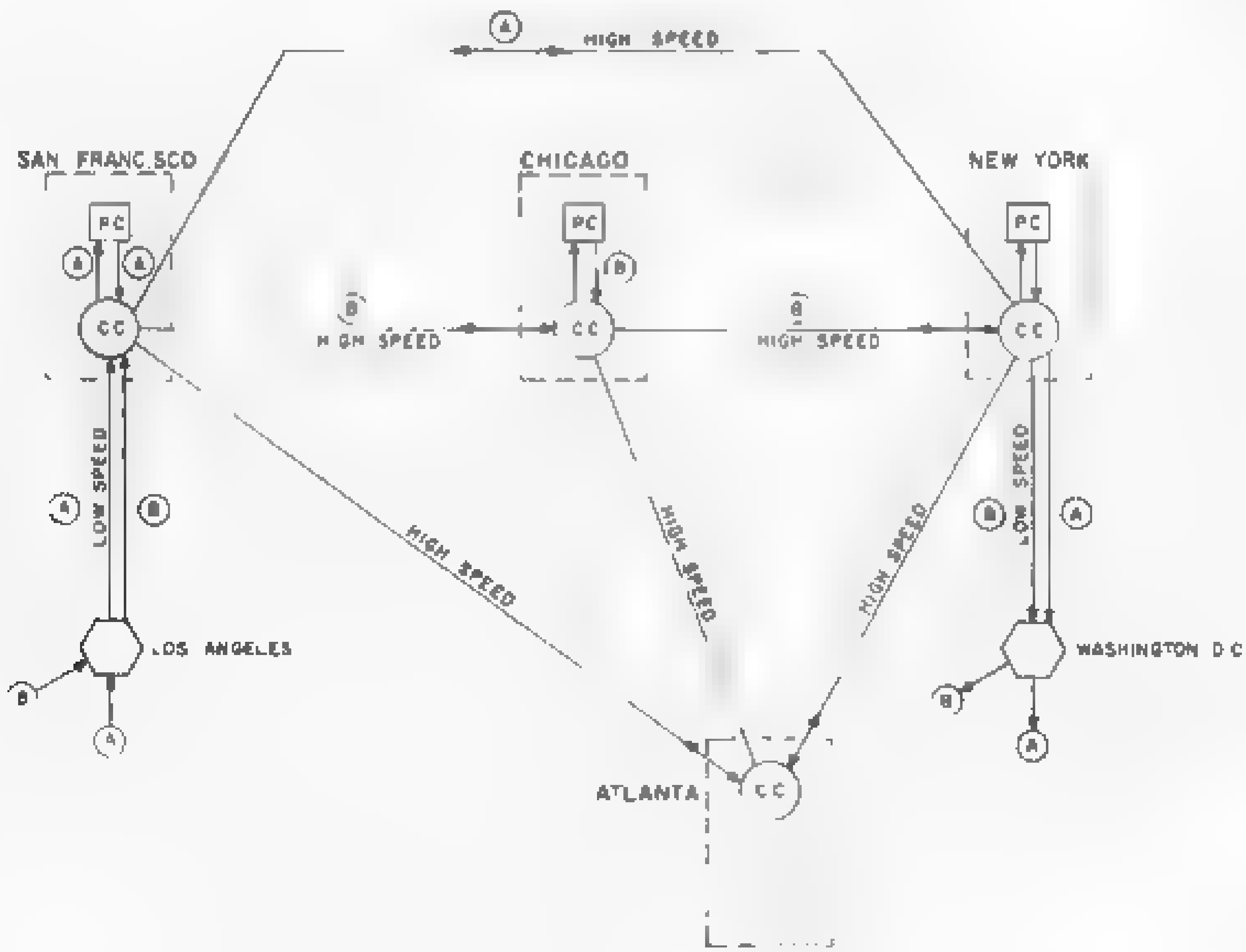

Figure 2. Message Flow through ISCS

speeds, other codes and a variety of terminal equipment will be accommodated as the system expands and the need develops.

In addition to the Class A and B services, there is also a need for an economical low-use terminal which would not necessarily have direct access to the computer center. This class of service, Class C, uses the Western Union Telex facilities (circuit switching system) to the high speed communications centers. This segment of the system will operate at 66 wpm, 5, level Baudot code at the terminals. Traffic from these stations will be code and speed converted at the communications concentrators for compatibility with the Info-COM network.

In this article the term "Info-COM Message Communications System" relates primarily to the directly connected stations, Class A and B, except when it is evident that interrelationship with Class C service is being described. The standard service features of Info-COM are

- 8 level U.S. ASCII code operation
- Accuracy assurance (parity errors flagged)
- 100 wpm half duplex operation with ASR terminals
- Alpha and/or alpha numeric addressing
- Standard message format (for inter-service operations)
- Message storage
- Multiple address messages
- System privacy
- Itemized billing
- Message number and date

The following optional features are available "on call" to a customer when his needs arise:

- Message retrieval (in-line retrieval within 2 hours; off line after 2 hours)
- 2 levels of priority—Regular and Precedence
- Alternate delivery

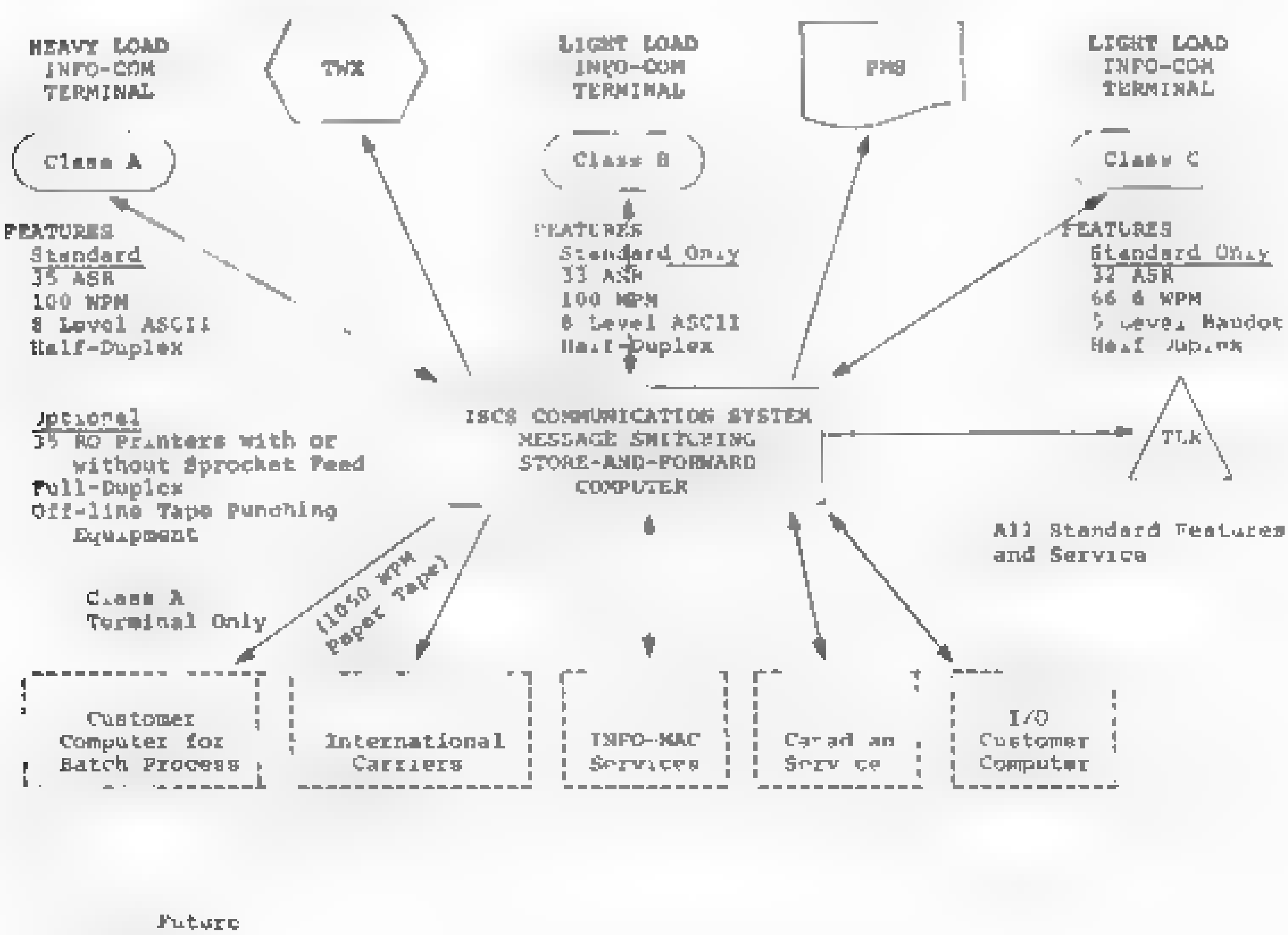

Figure 3. Typical Customer Network

There are some special features which may be ordered by the customer to supplement his service functions and terminal equipment such as:

- Full duplex terminal operation, 100 [illegible]
- High speed (1050 wpm) receive only terminal.
- Receive only terminals (in addition to basic ASR)
- Multiple machine installations (on-line and off-line)
- Group codes
- Traffic load reports
- Traffic distribution reports

It will be noted that these features very closely parallel the service capabilities offered by dedicated private wire computer systems.

Since the system is designed to handle many customer private message and data networks, it was necessary to provide for a means of assuring network privacy, and thus prevent one customer from accessing another customer's network by accident. The system of privacy employed is a double checking technique, making use of terminal answerback units and network codes. Network privacy is one of the key features of this service.

While a customer network may consist of any number of stations, a network of less than 5 stations would be impractical. On the other hand, dedicated computer switching systems are economically feasible only with more than 40 stations. These dedicated systems are, by design, capacity-limited. The Info-COM service has many advantages over the small network and the dedicated system, stations can be added or deleted almost as simply as they are in the Telex or TWX systems.

Message Format

System operation is simple and straightforward. There are, however, certain operational procedures which must be followed as in every computer system of this type. A prescribed message address format must be strictly adhered to for accessing the system. Should this format be violated, the message will not be accepted by the system and a message rejection notice will be sent to the originating terminal. This is necessary to protect the system integrity and to help assure message delivery. A sample message format is shown below.

Single Address

Line 1: Start of <u>Message</u> <u>Message</u> <u>Number</u> <u>Priority</u> <u>Billing</u> <u>Information</u> (CR) (LF)<

Line 2: Network Designator Routing Information (CR) (LF)<==

Line 3: Secondary Routing Information (CR (LF)<==

Line 4: Beginning of Text (End of Routing) (CR) (LF)<==

Line 5: Text (CR) (LF)

Line 6: End of Message

Line 7: Acceptance Message

Explanation

Line 1: Each message originated by a Class A or B Info-COM terminal shall begin with the U.S. ASCII character EOA followed by the character sequence ZCZC. The message number priority, and billing information with regard to P.M.S. Public Message Service and Telex traffic are underlined to indicate that these are optional fields.

Line 2: The following network designator indicates the type of delivery

TLX	Telex System (non Info-COM)
TWX	TWX System
ICS	Info-COM Terminal
PMS	Public Message System
GCS	Group Code for any combination of above

The routing information associated with each to the above is as follows.

TXL	Dial number and answerback
TWX	Dial number and answerback
ICS	Mnemonic routing code
PMS	Name and address of recipient
GSC	Mnemonic routing code

Line 3: Between the routing line and the beginning of text sequence there may be supplementary routing information on all messages except those having P.M.S. designators, to facilitate delivery of the message at the final destination. P.M.S. messages must contain

this area since the City and State names will appear here. Any number of physical lines of information may appear as supplementary routing information. Supplementary routing information may not follow a routing line containing a group code.

Line 4 The character sequence (CR) (LF) BT (CR) (LF) will serve as an end-of-routing boundary for all addresses

Line 5 This area may contain any sequence of characters except

1. ZCZC
2. NNNN
3. Figs. D
4. (CR) (LF) BT (CR) (LF)

Line 6: The character sequence NNNN will serve as an end-of-message indicator and also the end text indicator In a multiple address message. The ASCII characters X-OFF shall follow the end-of-message originated by a Class B station on the end-of-message sequence of the last message of a series originated by a Class A station.

Line 7: The acceptance message shall contain the following.

(a) message number assigned by the originator
(b the input number assigned by the system
(c) acceptance notice or a rejection notice and the reason therefore

Accuracy Assurance

Accuracy assurance will be provided by the Info-COM network within the economics and operational constraints of the system Parity errors recognized by the computer will be flagged by an appropriate symbol. No message will be rejected or withheld from delivery because of parity errors by the system.

The system will not reject or withhold delivery due to parity error content It is expected that as the system develops, and as advanced terminal equipment becomes available and an on-line computer interface becomes a reality, the level of accuracy assurance will be expanded.

Itemized Billing

A consolidated bill for all stations on the network itemized to the extent that each station, by mnemonic, will be listed with access charges, optional equipment charges and traffic volumes will be furnished to the subscriber on a monthly basis.

Acknowledgement

Acknowledge notices will be sent for each message that the Processing Center has received. When the processor is unable to send an acknowledgement message or when there is reason to believe that the originating office may not receive an acknowledgement message sent by the processor (e g., failed circuit), the acknowledgement will be delivered to the W.U. supervisory acknowledgement position with a statement of the nature of the trouble. The supervisory acknowledgement position supervisor will take whatever steps are necessary to make sure that the originating trib station is aware of the disposition of the message.

Network Control Station

A key feature of the Info-COM system is a customer Network Control Station (NCS). One of the principal trib stations of each customer's network will be designated as the "Network Control Station." Operational liaison between Western Union and the customer will be conducted via this station. Trouble reports from ISCS are routed to the network control whenever traffic cannot be delivered to any station, in a customer network, after a predetermined time. The customer will be able to establish, immediately, an effective alternate destination by sending an appropriate service message Thus it will be able to restore normal routing. Current network status reports can be requested for any Class A or B station or for the entire network. The status of the station the number of messages in queue, and the oldest message will be furnished in each station report. Off-line traffic load and traffic distribution reports will also be available to the network control station

The NCS can request various types of Service Messages, Reports and Functions

Service Messages

A service message is defined as a communication from a subscriber station or a Network Control Station to the ISCS system Upon receipt of a service message, the ISCS system will respond as follows

a. Acknowledge receipt of the service message

b. Perform the appropriate operating function

c. Logs on the appropriate operating positions

The standard incoming format is used for all service messages. When preparing the service message, the mnemonic designation of the desired function is inserted into the Mnemonic Address Code field of the standard format.

The following service messages can be originated by a subscriber terminal

a) Service STATION IS OPERATIONAL
Mnemonic Code—SRVGM

Function: This message indicates that the calling terminal is on line and operational. The ISCS system will respond with an acknowledgement and also notify the network control station. All traffic stored in the intercept queue for this terminal will be delivered now

Example: SVC
SRVGM
Station Mnemonic
NNNN

b) Service HOLD TRAFFIC
Mnemonic Code—NCSSR

Function: This message indicates that the calling terminal will cease operation. The ISCS system will respond with an acknowledgement and also notify the network control station.

Example: SVC
SRVGN
Station Mnemonic
NNNN

c) Service RETRIEVE MESSAGE FROM FILES
Mnemonic Code—SRVGN

Function: This message indicates a request for the retransmission of a message that had been delivered during some period prior to the two hours from the current time. The service message text will contain the outgoing message number, the date, and the mnemonic of the terminal to which the message was addressed The message will be delivered only to the terminal specified in the header of the retrieved message or to the network control station.

Example: SVC
SRVRQ
Station Mnemonic
LASNTCY 0911 0021
NNNN

Message sent by terminal NYCTY to resend message number 0021 of September 11.

The following service messages can be originated by a Network Control Station:

a) Establish Alternate Route
Mnemonic Code—SRVGQ

Function: The NCS may change the routing for any terminal in its network, i.e., messages designated for Terminal A will be sent to Terminal B until a new message is sent by Network Control. Rerouted messages will not automatically be resent to the original terminal when a new message restores the original terminal when a new message restores the original routing. This message is used for a temporary change only. The text contains the mnemonic routing codes of the FROM station and TO station. To restore original, the mnemonics from FROM and TO should be the same.

Example: SVC
NCSRC
LASBOST LASNYCT
NNNN

b) Changes routing from LASBOST to LASNYCT
Service SEND TRAFFIC
Mnemonic Code—NCSRC

Function: This message indicates that the Network Control Station wishes to attempt to remove a terminal from "Hold Traffic" status. All traffic stored in queue for this terminal will now be delivered to it. This service message can only be sent by a network control station

Example: SVC
NCSOP
LASNYCT
NNNN

The mnemonic LASNYCT within the text of the message denotes the station that is affected by the request.

c) Network Control REQUEST STATUS REPORT
Mnemonic Code—NCSOP

Function: This message is used to direct the system to prepare the report defined under System Reports.

Example: SVC
NCSSR
STAT
NNNN

Requests network Status report as of "Now". If the status of a terminal were requested, the mnemonic of the terminal would follow STAT in the text

Reports

The customer may subscribe to the following off-line and on line reports:

Off Line

a) *Traffic Load Report*

This report shows for a given hour the number of characters and messages sent and received on a per mnemonic basis

An example of this type of report.

Traffic Load Report Date-Time 00111000
Report-Period 1600

Terminal Mnemonic	Char. Sent	Char. Rec'd.	Msg. Sent	Msg. Rec'd.
LASBOST	1376	807	41	26
LASNYCT	0	788	0	24
LASM SF	2124	654	75	21
LASLOSA	61	8663	7	205
LASWASH	2784	1441	102	63
LASM AM	93	2384	5	107
LASCHIC	0	0	0	0
Total	8505	261948	530	2417

b) *Summary Traffic Load Report*

This report will be identical in format to the one described in (a) above but will summarize the traffic for one of the following periods: day, week, month

c) *Summary Traffic Distribution Report*

The Traffic Distribution Report shows for a given hour period the number of messages and characters sent by each terminal to each of the other terminals in the subscribers network.

The following is a Summary Traffic Distribution Report

Traffic Distribution Report Date-Time 0011 1000
Report Period 1600

Reporting Terminal	Boston			
Terminal Mnemonic	From Reporting Terminal Msg.	Char	To Reporting Terminal Msg.	Char
LASNYCT	5	250	1	63
LASMISF	2	130	3	159
LASLOSA	0	0	1	75
N				
TOTAL	24	1400	19	942
Reporting Terminal	NYCTY			
LASMISF	4	210	2	300
LASLOSA	10	763	6	360
N				
TOTAL	32	1676	14	1200

On-Line Status Report

This report is requestable by and deliverable to the NCS only. The number of messages in queue, the status of the station, and the date-time of the oldest message will be given for each terminal specified. NCS may request this report for any individual terminal, combinations of terminals, or his entire network. An example of this report follows:

Terminal Mnemonic	Status of Station	Day and Time Rec'd Oldest Message		Messages in Queue Normal	Rush
GEN0001	HOLD	01	1956	015	036
GEN0002	NORMAL	01	2132	001	000
GEN0003	NORMAL	01	2056	022	003
GEN0004	GEN0003	No Traffic			
GEN0005	NORMAL	No Traffic			

Message Storage and Retrieval

Western Union will retain copies of all traffic passed thru the ISCS system for a prolonged period as required by the FCC

Messages will be retained in the computer memory for a period of two hours: during this period messages may be retrieved on an on-line basis by the customer. After this period, message retrieval will be accomplished off line. Message retrieval will be available for Class A and B stations only

Alpha/Numeric Addressing

The Info-COM service will use the alphabetic/numeric system of addressing. Each address will consist of seven characters. The first three left-most characters will be the particular Info-COM network alpha designators. Of these, two characters of the three positions will contain characters which are unique to each network. The remaining four characters may be of any combination of alpha/numeric characters.

Messages destined to other services will be addressed in the formats prescribed for this purpose.

Group Codes Service

Group destination codes will also be used as routing indicators. Upon recognition of a group code, the processor will determine which stations are addressed by searching through its group code files. Group codes represent from 2 stations per code up to a network broadcast (all stations). Group codes will not include stations of other subscribers' networks, but may also include PMS, TWX and Telex station address. All messages will be delivered at the same priority, at that defined in the message header. No modification of the group code address will be accepted. The group code will be 7 characters. The first 3 left most characters will be the particular Info-COM network alpha designators. The remaining 4 characters will define the group code. Of these, two of the four character positions will contain characters which are unique to that group code.

Multiple Address

Multiple address service will be available to the Info-COM customers in addition to the group code service. The priority level will be "regular" for all destination stations unless a precedence level symbol is noted beside the address requiring precedence handling. Each station shown on the multiple address list will receive identical messages, listing the origin station and the address of the one station. One copy of the message will be delivered for each address. In the event one of the stations on the address list fails, the message destined for that station will be delivered to a manual position within the Western Union ISCS Center for special handling. Multiple address messages may include addresser for delivery to other services, i.e., Telex, PMS and TWX. Group codes may be included as an address on Multiple Address list.

Priority

The initial system shall contain two levels of priority: "regular" and a higher level "precedence." The "precedence" level will have priority over the "regular" messages in queue. In no case will a precedence message interrupt a message being transmitted to a customer's station. Messages generated from the Processing Center (service messages) will be assigned a level of priority by the Processing Center supervisor. Priority only applies to the Class A and B Info-COM Service; it does not apply to Class C, PMS, TWX or Telex.

Message Numbering

The message number is that number which the originator assigns to each single address message or to each address of a multiple address message. The first single address message of a connection may be assigned any number by the user or may contain no message number. Subsequent messages of the same connection must be assigned numbers and these must be in ascending, but not necessarily sequential, numerical order. Similarly, the first address of a multiple address message may be assigned any number by the user or may contain no address number. Subsequent address of the same message must be assigned numbers and these must be in ascending, but not necessarily sequential, numerical order.

The processing center will acknowledge receipt of messages on an individual basis at the end of each period of transmission.

Alternate Delivery (Routing)

The network control station will provide the ability to establish alternate routes and to cause the system to hold traffic of specific stations for subsequent

delivery. The customer's network supervisor may designate an alternate destination to which messages will be delivered in the event of a station shutdown. The alternate delivery (routing) procedure will be normally initiated by the customer network supervisor, however, in certain instances it may alternatively be initiated by the Western Union supervisory position at the Processing Center.

Operation

The following is an operational overview of the three classes of Info-COM service from a terminal viewpoint.

Class A—Half-Duplex Operation
Subscriber Sending

While the user is preparing his tape, no local copy of the message will be produced during the normal operation. During this period, the printing unit can be selected by the ISCS for the delivery of a message.

The user may place his terminal in the local mode while preparing tape. In this case, a local copy will be produced. However, during this period, the ISCS cannot pre-empt the terminal in order to deliver a message.

When the user is ready to transmit his message(s), he will position his request button or place it on automatic if he has more than one series of messages which will notify the ISCS that he is requesting service. The system will respond with an invitation to send which will start the transmitter or produce a visual indication that the user may begin transmission via the keyboard. During the period of transmission, the typing unit shall monitor the transmitter of the keyboard in order that a local copy of the message may be produced.

The terminal shall react to the ASCII character X-OFF and the transmitter shall stop. The ISCS then shall deliver an acknowledgement message to the terminal. This acknowledgement will include the message number(s) (if present) (address numbers in the case of a multiple address message), assigned by the user and also the connection number assigned by the ISCS. This acknowledgement will also include for each message, an acceptance notice or a rejection notice and the reason therefor.

Following the delivery of the acknowledgement message, the ISCS may make a delivery to the terminal or issue a new invitation to send if the automatic request indicator has been selected.

Class B—Half-Duplex Operation
Subscriber Sending

The user will prepare his tape with his terminal in the local mode. During this period, the ISCS will not be able to preempt the terminal for the delivery of a message. Also, a local copy of the message will be generated during the period of tape preparation.

When the user is ready to transmit his message(s), he will position his request button or place it on automatic if he has more than one message which will notify the ISCS that he is requesting service. When the line becomes free and the ISCS has determined that the terminal is to be serviced, it shall respond with an invitation to send which will start the transmitter or produce a visual indication that the user may begin transmission via the keyboard. During the period of transmission, the typing unit shall monitor the transmitter and produce a local copy of the message.

The terminal shall react to the ASCII character X-OFF and the transmitter shall stop. The ISCS shall deliver an acknowledgement message to the terminal. This acknowledgement shall include the message number if present, or the address numbers in the case of a multiple address message, assigned by the user and also the message number assigned by the ISCS. This message shall also include an acceptance notice or a rejection notice and the reason therefor.

Following the delivery of the acknowledgement message, the ISCS may make a delivery to any terminal on the line if it has traffic to send or it shall check the other stations on the line to determine if they have traffic to send before permitting this station to resume transmission.

If the user includes more than one

message between the ASCII control character EOA and X-OFF, the ISCS will stop the transmitter, alarm the position, and deliver the acknowledgement message for the first message the user sent. The alarm shall be both visual and audible. Manual intervention shall be required to permit the terminal to proceed.

Class A and B—Half-Duplex Operation ISCS Sending

When the ISCS has selected a terminal for the delivery of a message, it shall precede the transmission by requesting the answerback of the terminal. This answerback will be checked to insure positive identification of the terminal.

Following the answerback check, the ISCS shall effect the delivery of the message. Following the delivery of the message, the ISCS shall request and verify the anwerback of the terminal.

A customer subscribing to this service would estimate the approximate use (sent traffic) for each station on his network in order to determine the most economical class of service to satisfy the station's requirements. A general rule of thumb can be used in estimating the station class of service. It should be remembered that the service will carry two basic types of charges; a station access charge, and a station usage charge. The access charge is based on the class of service, Class A highest charge and Class C lowest charge. This usage charge is calculated on the sent traffic from that station; no charge is made for received traffic. For stations with traffic loads in excess of 20 hrs. per month, Class A service will prove to be most practical and economical. For traffic loads between 3 and 20 hrs. per month, Class B service would be appropriate, while for loads less than 3 hrs. per month, Class C service should be specified.

* * * *

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2. Information Service Computer System, John Hunt, Western Union TECHNICAL REVIEW, Vol. 21, No. 2, April 1967.

Henry P. Bechtold, Program Director of Info-COM in the IS&S Department, he joined Western Union in March 1966 and has been instrumental in structuring this new Info-COM service offering. Prior to joining Western Union, Mr. Bechtold spent 8 years in management positions with Litton Systems, Westrex Division responsible for their communications product planning and market development. Past experience includes a number of years with the Bell System on various projects in the Radio, Telephone and Telegraph fields, both domestically and internationally. During World War II, he served in the South Pacific as a Staff Officer in the Hqs. 8th Army Signal Section, responsible for multi-channel radio, telephone and telegraph systems.

He attended Pratt Institute and holds memberships in the IEEE and Independent Telephone Pioneers Association.

modern facilities for new systems and services

Editor's Note The following is extracted from an address by Russell W McFall, Chairman of the Board and President of Western Union, at the annual meeting of stockholders in Chicago, Illinois on April 12, 1967

I should like to thank you, on behalf of the Directors, for your active interest in the Company. . . . The active interest of shareholders in the Company is most gratifying. .

The modernization and expansion program, now well along the way, will provide the expanded base of modern facilities necessary to improve our present services, and to offer new communication and Information systems and services. It takes time however, for the results of new systems and facilities to be fully reflected in revenues and earnings. In our kind of business, a new facility does not start to produce maximum results the day it is put into service; instead, the facility is filled up as customers are added

.The Company's first Information Services Computer Center, located on the ground floor of our headquarters building at New York, was placed in service a little over a year ago

. . Western Union Telex, as you know, is a dial-direct teleprinter exchange service for the transmission of messages and data . . . .

The first of the new Automatic Computer Telex Services, which we call "ACTS," is a Telex-to-TWX message service. This permits a Western Union Telex subscriber to send messages to subscribers of the Bell System's Teletypewriter Exchange Service . . . .

The completed center at New York will soon be linked by high-speed communication channels with additional computer centers, in a nationwide system.

Another computer center, which will serve Telex subscribers in the central states, is nearing completion in the Western Union Building here in Chicago.

Computer centers are also nearing completion at San Francisco and Atlanta. When all these computer centers are in service, later this year, they will make the new automatic services available to Telex subscribers from coast to coast.

The computers in all these centers will have multiple-access capabilities, which will make it possible to offer a new service called "INFO-COM," which Western Union engineers have developed to meet an increasing need by industry for computer-operated message switching, data collection and similar services on a shared-use basis. .

Western Union's new communication and information systems and services, and its new public services, which I have described, are characteristic of a forward looking Western Union

In addition, Western Union today has a management team of substantial strength and ability—and, I am glad to say, in some depth.

With these important factors at work, I believe that Western Union is prepared, indeed, to meet the challenging years ahead

Thank you.

*SICOM**

securities industry communication system

Vincent Hamill and Kenneth L. Brody

The securities industry is probably more dependent upon the rapid flow of volumes of accurate information than any other business. Its cost of communications is a major portion of its total cost of operation.

The greater portion of the communications and information activity in securities firms is in the transmission of orders to the exchange floors and the subsequent confirmation of transactions from them. Other activities include movement of administrative traffic, market data reporting, account status maintenance, account billing, financial report preparation and securities analysis.

Western Union's Phase I Securities Industry Communication System provides the service of shared transmission and computer-directed switching of orders and administrative message traffic for members of the brokerage community. Each subscribing firm accesses the system by means of dedicated teleprinter and low speed circuit facilities, and utilizes a portion of the common transmission and switching facility to derive a service equivalent to that obtainable by employing dedicated computer and transmission facilities. No communication is provided between the subscribing firms.

* Western Union Trademark

This shared transmission and computer-directed switching service will be augmented, in a phased program, by offerings of data processing services utilizing the data base generated by the initial service. These additional offerings will be oriented to the particular needs of the brokerage firms and may include day order matching, open order file maintenance, research reports, retrieval functions, and back office data processing applications.

The services afforded by the Phase I Securities Industry Information System are restricted to use only by members of the brokerage community (member firms of the New York Stock Exchange, American Stock Exchange, regional securities exchanges, etc.). Figure 1 illustrates the normal activity in the New York Stock Exchange. These services are offered nationwide to all such firms. It is believed that medium sized firms will be the largest users and derive the greatest benefit from this system, since they have requirements for rapid, accurate and low cost communications and communications based information services but they lack the ability to afford the necessary computer equipment and transmission facilities. Large firms can justify investment in their own computer equipment and transmission facilities to provide these services based on

savings in labor and competitive status. Small firms minimize their needs for such services by entering into correspondent relationships with larger firms.

Western Union is a retailer of service to the brokerage community. In this capacity, it has designed the Phase I Security Industry Communications System, has specified key equipment components, and has created the programming system of instructions for the computer center. In addition, it has: procured all commercially available equipment, had special equipments fabricated to its design; installed conditioned and tested all equipment established all circuit facilities; tested the complete system; installed and tested patron equipment; and trained customer personnel in use of the system. Western Union provides full maintenance of all equipment and lines and operates the computer center.

The Phase I Securities Industry Information System is composed of a multi-computer switching and processing center located in Mahwah, New Jersey, and a national communications network radiating from this center. This communications network consists of full duplex, high-speed data channels (Western Union Class F data service) terminating in concentrator units located in key metropolitan areas throughout the United States. The concentrator units, Western Union's Dalcode (Delay Line Concentrator Deconcentrator) devices, operate on time division multiplex principles. Up to twenty-five such high speed data channels and Dalcode units may be accommodated. Each Dalcode installation includes an operating unit and a spare unit, with automatic fallback to the spare, in the case of malfunction under control of the computer center. Fallback for the high speed data channels is afforded thru diversely routed transmission paths, from which equivalent high speed data channels are derived on a dial-up basis, using Western Union's Broadband Exchange Service or alternate full period Class F data channels.

Figure 1 — New York Stock Exchange

Dalcode*

Each Dalcode unit terminates up to twenty-six low speed full duplex 75 bps channels, operating with a 5-level code. These low speed channels may be arranged to directly connect a single tributary station to the system or may be arranged as way circuits terminating up to six such stations. Tributary stations may be located within the same city as their respective Dalcode connection or at another location. Each tributary station is composed of one or more units of Model 28 ne teleprinter equipment under control of Western Union Plan 117B type solid state way station selectors.

Computers

The computer system is composed of four Univac 418-II computers with associated peripherals such as: High Speed Communications Terminal Modules, Standard Communications Subsystems, Fastrand Drums, FH-330 Drums, Type VI-C Magnetic Tape Subsystems, and 1004 Printer/Punched Card Subsystems. One of the computers is designated as the Front End, and performs the functions of communications line control and message blocking. The Front End is connected via an Intercomputer Synchronizer to a Message Processor computer, which provides message validations, journalling, logging, routing and retrieval actions. A third computer, a fallback unit, is available to replace the first two, or the fourth unit, in the event of malfucntion. The fourth unit, the File Processor, is not utilized to provide the order and message switching service, but will be employed to render the aforementioned data processing services. Each peripheral unit required for system operation is duplicated and connected to the computers via an array of peripheral device transfer switches, which allows manual removal and replacement of malfunctioning units.

*Western Union Trademark

Advantages of SICOM

SICOM* computer-directed order and message switching service offers a number of advantages to the brokerage community

1. Order messages are switched automatically to the patron's booth on the floor of the New York Stock Exchange which services the post at which the stock, referenced in the order, is traded as shown in Figure 1. This is done by analysis of the text of such order messages.
2. Order messages are validated for conformance with NYSE format requirements. Errors will result in rejection of the message or its routing to a station designated by the customer for the handling of such traffic. Administrative messages are validated for header logic and are similarly treated.
3. Messages switched thru the system are tagged with destination station codes and delivery sequence number, date, the time received at the computer center and the time transmitted from the computer center.
4. Messages switched by the system within the prior 24 hour period may be retrieved by each respective patron on an on-line basis. Messages switched within the prior six-month period may be retrieved on an off-line basis.
5. Greater flexibility in the design of specific customer networks derived from the Phase I Securities Industry Information System is possible by elimination of the constraints imposed by the configuration of stations on individual cross-country low-speed circuits.
6. Faster transmission of messages is made possible by eliminating traditional way circuit concepts and replacing them by a mode of operation which affords each subscriber the advantages of a direct connection to the computer complex.
7. The economies realized by the shared

use of transmission and computer facilities will be reflected in the rates for this service

8. Shared use of transmission and computer facilities permit employment of fallback equipment and circuit facilities. Thus significant improvements in the reliability and continuity of the service are possible.

Up to three levels of message delivery priority are provided for subscriber-originated messages: immediate, routine and deferred. Orders may have immediate priority; floor reports and administrative messages can be designated as having any one of the three priority levels, at the users option

Service messages generated by the processing system, in response to equipment failures or format errors, and sent to subscribers have the highest priority in the system since they affect the quality of subscriber terminal operation. Unique service messages will be generated to the subscriber sending station and to the subscriber's network control station to identify each type of error or failure detected by the processor

Message Flow

Messages intended for SICOM* are prepared in punched paper tape by the subscriber terminal operator, and placed in the paper tape reader of the terminal unit. Western Union's solid state Plan 117 subscriber terminal control units are used at all stations. When the first message is in the tape reader and ready for transmission, the operator pushes a request button

*Western Union Trademark

(courtesy of New York Stock Exchange)

Figure 2.—Trading Floor of New York Stock Exchange

The processing center accepts the message by sending an automatic control signal which causes the terminal tape reader to send the message into the system. The terminals send at 100 word per minute, 10 character per second rate.

The Dalcode units relay the messages from the low speed subscriber terminals over the high speed lines to the communications center. The processing and switching computers, at the center, check each message as it is received from a subscriber terminal and verify the correctness of the message format for each message received in the system. If a message passes the message format checks, the processing system accepts the message for handling and relay to its destination.

The destination may be the trading floor of the New York Stock Exchange as shown in Figure 2 or American Stock Exchange, or a brokerage firm back office location, or any other administrative office location. Messages are forwarded to their destinations from the message processing center over the high speed lines to the Dalcode units from which they are relayed to the low speed subscriber terminal units. Subscriber terminals are served by full duplex transmission facilities which enable the subscriber terminals to simultaneously send and receive different messages over the network.

Western Union will supply complete format and operating routine documentation for all subscriber terminal and network control stations, and will provide operator training for each subscriber, including "Hands-on" practical operating experience.

Message Formats

SICOM is designed to accept the standardized order formats developed by New York Stock Exchange.

Quality Control and Message Assurance

The Phase I Securities Industry Information System has built-in safeguards, both in "hardware" and "software," to insure system quality control and message delivery assurance.

1. Among the hardware safeguards are the following:
   a. Proven, highly reliable solid-state electronics throughout the system at processing center, Dalcode sites, and subscriber terminals.
   b. Fallback equipment at the processing center and Dalcode sites to prevent loss of any major system hub.
   c. Character parity checking on high speed data channels between processing center and Dalcodes.

2. System software safeguards include the following.
   a. Program control of all incoming messages through processor "polling" or "invitation to send" cycling of all stations, and verification of station response to "polling."
   b. Program control of all outgoing messages through processor recognition of proper subscriber terminal response to station address code prior to message delivery.
   c. Processor verification of proper sequential message numbering on inbound messages from each terminal to guard against loss of incoming messages.
   d. Processor assignment of proper sequential message numbering on outbound messages to each terminal, to prevent loss of outgoing messages.
   e. Processor verification of proper message formats to protect against operator errors or equipment or transmission line failures.
   f. Processor validation of destination address codes.
   g. Processor retrieval and redelivery of specific messages by number upon request from subscriber termi-

nal station or subscriber network supervisor

h Processor generation of service messages to identify error conditions upon recognition.

i Processor generated statistical report for each user giving total messages sent and received per station etc.

SICOM is designed to provide brokers with rapid accurate business control in a securities communication system. It reduces his problems of training, maintenance and system updating thus guaranteeing him the advantages of the latest communication and information breakthroughs.

VINCENT HAMILL, Director-Securities Business Service in the Information Systems and Services Department has the responsibility for market planning of Western Union services of a shared nature for the Securities Industry. He joined Western Union in 1966.

Mr. Hamill has held positions as Account Representative, Industry Manager, and National Account Executive with RCA and IBM. He has 7 years of experience in the financial community and was responsible for the sale and implementation of several of the larger systems now in use on Wall Street.

KENNETH L. BRODY, Director-Security Business Projects, in the Information Systems and Services Department is responsible for the systems engineering and project management of Western Union's communications and information systems and services for the securities Industry.

Mr. Brody had a major role in the installation of many Western Union Management Information Systems such as Dun & Bradstreet, 3M, Hutten, etc. He joined Western Union in 1954 as an engineer responsible for contract management, after service as communications officer in the USAF.

He is a member of the AIEE, Tau Beta Pi and Pi Tau Sigma.

HOT/LINE

a unique voice service

Harry J. Cowin

First Concept

Several years ago Western Union began a field trial of a unique voice service. It was the first offering of a new, intercity private line business telephone service, featuring instant, automatic connections, with no dialing and no minimum-time charges. The original concept is credited to A. J. Connery of Western Union, now retired. Mr. Connery developed the notion of using a group of shared voice grade trunks between two cities for several private wire voice customers, instead of each customer utilizing his own individual private voice grade channel. In order to permit a customer access to the trunk group and connection to the correct party at the distant end, Mr. Connery utilized line concentrators. While the principle is not new, this particular application was and is considered unique. To further distinguish the service, billing was arranged on an actual toll usage basis, rather than the accepted method of a fixed monthly rental based on the intercity mileage involved.

Hot/Line became a reality in June, 1965, when 28 customers in New York were placed in service with their 28 correspondents in Chicago. This was the prototype used to further study and refine the technical aspects as well as the marketing requirements under actual field service conditions. A temporary interstate tariff was filed, establishing a monthly rental for the customer's telephone equipment and a per minute toll rate for its use. More specifically, the usage rate was based on pulse metering of six-second intervals. This feature, when compared to standard toll practices of the telephone industry, enabled Western Union customers to be billed much more precisely for the conversation time actually used. For example, the average length of call of 28 prototype users was found to be about 1.2 minutes. With a 3.5 cent six second pulse rate charge the average cost would be about 42 cents per call. The same call placed through long distance would cost \$1.40 plus 14 cents tax, or a total of \$1.54. The three minute minimum on toll service, plus the one minute minimum on overtime, gave Hot/Line a decided cost advantage.

Figure 2 — Hot/Line Expansion

Improvements

To further improve the Hot/Line service several other features were incorporated camp-on, automatic ringing, exclusion, and multiple extensions. "Camp-on" circuits were included in the central office equipment to enable a customer to simply hang up, if he found all the trunks busy. The "camp-on" equipment seizes the first trunk when it becomes available and rings back to establish a connection to the called party When it rings back, it automatically rings the called party as well. As an additional convenience, automatic "off hook" signaling is included No dialing or push-button signaling is required. As the customer lifts the hand-piece, the equipment seizes an available trunk and begins ringing the distant end, in about one second maximum

Extension stations were added to the offering, as well as local extension station signaling arrangements. An exclusion or privacy feature was also added at the main station instrument permitting the user to cut off the extension stations if privacy was required

Customer Acceptance

The Hot/Line prototype installation proved to be highly successful. The few technical problems were quickly resolved, these concerned improvement of the speed of connection. From a marketing viewpoint, the concerned conclusions strongly supported the earlier judgments about customer acceptance and marketability. Market research interviews indicated the usage concept for billing was very well received by the customers. They reacted favorably to the "camp-on" feature, the high speed no-dial connection time, as well as the exclusion feature and the flexibility afforded by the extension stations. In short, the only complaint received was about the lack of Hot/Line service to other cities.

Expansion

Consequently, the decision was quickly made to formally expand Hot/Line service. New tariffs were filed late last year expanding the service to include Hot/Line systems between New York City and San Francisco and Los Angeles, as well as Chicago. The first official inauguration took place on January 15, 1967 when two systems, each with capacity for 54 customers, were placed in service between New York City and Chicago. The new equipment has a capacity for 16 intercity trunks and six "camp-on" circuits per system.

Twenty-nine systems or inter-city links are planned for 1967. Eight systems are already in service at this time, with the recent addition of one between Los Angeles and San Francisco. Washington, Detroit, Cleveland, St. Louis, and Dallas will be added to the list of Hot/Line cities in the months ahead. In all, 26 major cities are planned for in the next year and a half, with a total of over 90 systems in service by the end of 1968 throughout the United States, as shown in Figure 2.

Initially, the customer response has come largely from the brokerage industry. This is due primarily to the fact that time is a critical factor in buying and selling securities and Hot/Line provides the fastest "person-to-person" service presently being offered. Secondly, these calls are brief thus giving the greatest cost saving. However, the Hot/Line pricing structure is such that there is always a saving regardless of the length of call. A customer needs only a minimum of 3 or 4 calls a day to the same distant number to accrue enough savings over toll service to more than offset the monthly equipment rental The greater the calling volume, the greater the saving. This has been proven by the rapid acceptance of the service and the growing diversity in the type of users

Applications

Presently, Hot/Line customers include such broad industry applications as.

- Importers
- Publishers
- Textile Manufacturers
- Television Stations
- Recording Companies
- Auto Rental Agencies
- Buyers
- Shippers
- Stock Brokers

The internal applications vary as well, including placing of sales orders, general administration, inventory control, order control, traffic or dispatch control, billing, reservations, as well as buying and selling Other possible applications or uses are presently being developed

As more cities are added and more and different types of users are developed Hot/Line will become a truly nationwide service, providing a specialized voice requirement to all segments of the commercial world

Presently, further improvements are being considered to expand the Hot/Line service

* * * *

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[1] A. F. Connery, Introduction to Broadband Switching, Western Union TECHNICAL REVIEW, Vol. 16, No 3, July 1962

HARRY J. COWIN, Director-Voice Systems and Services in the Information Systems and Services Department, has been Program Director for Hot Line since July 1966. He has had extensive experience in the communications industry with both the Bell and General Telephone systems. In addition, he served with the Latin American division of ITT's International Communications Operation prior to joining Western Union in 1966. His background includes outside telephone plant construction, installation and maintenance, local commercial operations, telephone equipment sales, and various headquarters marketing positions. He has been Product Manager, General Sales Manager, Division Operations Manager, as well as Executive Assistant to the President of ITT ICO for Commercial Operations and Sales in Latin America.

Mr Cowin has also served on the Advisory Committee to the Public Utility Executive Program at the University of Michigan

*DIAL-PAK**

a new broadband service

F. J. Aler

DIAL-PAK*, a Broadband Exchange Service, is a new concept by Western Union, which provides direct computer-to-computer communications using a 48kc wideband switched system and a 40,800 baud dataset. This flexible facility will also provide for the transmission of high speed analog signals in lieu of digital data signals, for those customers having this requirement and having suitable input/output apparatus.

Voice coordination and alternate/voice use is another feature of this service which will be provided on a simple "call-up" basis, which is illustrated in the Automatic Answering Unit shown below in Figure 1.

Figure 1 Automatic Answering Unit

* Western Union Trademark

Industry Requirements

As industry decentralizes and research, manufacturing and marketing facilities are located greater distances away from the home office and from each other, the need for faster, more reliable data communications becomes increasingly important. Corporate mergers likewise increases the need for fast management information from the various components of the widely dispersed empire. The requirements of new industries, unheard of a few years ago, such as aero-space, has generated additional needs for rapid data communications.

Only a decade ago a brief telegraphic report, telephone conversation or limited data processing exchange satisfied most requirements. Today, data processing users, their complex needs and explosive interests require a wide range of data communications capabilities.

To meet this challenge, Western Union developed the Broadband Exchange Service, a system which automatically links many subscriber locations over those transmission channels best suited to their communications needs.[1] Currently two grades of service are offered on Broadband. Schedule I (2kc) and Schedule II (4kc). These "voice grade" capabilities have been available on a "call-up" basis since late 1964. DIAL-PAK, a third grade of service, is the next logical step in providing wider bandwidths which keep pace with the ever expanding needs of our society

Special Features

DIAL-PAK* subscribers will have available many of the features so popular with users of the narrower Broadband Exchange Service facilities.[2] Each user location will be equipped with the standard Broadband voice instrument, shown in Figure 2. This telephone was specially designed to serve the needs of data communications.

The telephone provides push buttons to initiate the multifrequency tones. These tones are converted to address digits, at the switching center, for proper routing of the call, via an outgoing trunk, to the distant exchange serving the called party.

In addition to providing convenient and fast push-button calling, each telephone instrument has a "voice" light which is activated when the handset is lifted from the cradle.

Also standard with each voice instrument is a "ring" button. Lifting the handset, during data transmission or reception and depressing the ring button, will cause the tone ringer at the distant end to emit a distinct audible sound, thus recalling the attendant to the voice mode. Unlike the Schedule I and Schedule II Broadband Service, DIAL-PAK* Service permits voice conversations and data transmissions to be carried on simultaneously.

* Western Union Trademark

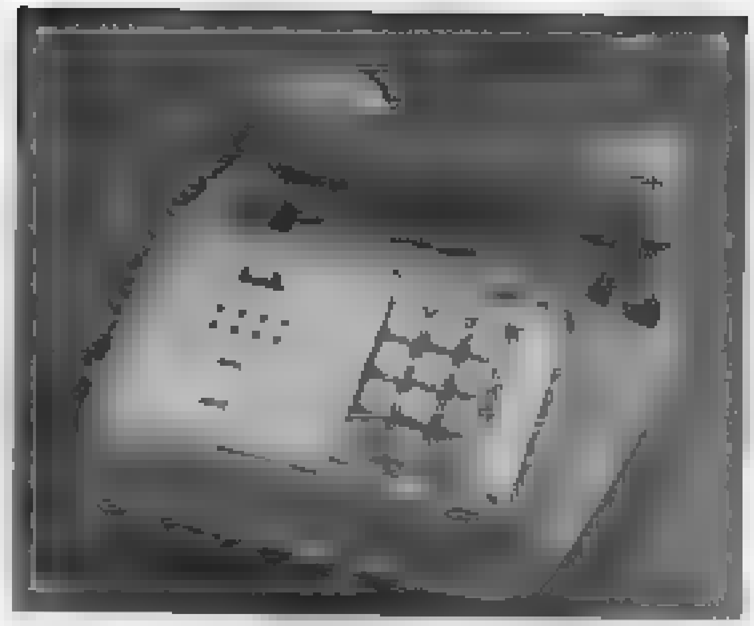


Figure 2. Standard Broadband Voice Instrument with Handset resting on cradle

Each DIAL-PAK* subscriber is assigned a seven-digit identification number. The first three digits indicate the switching center in which the subscriber is terminated. The 4th digit is the numeral "9" which is used to signify that the subscriber has access to the 48kc trunks. The last three digits refer to the subscriber station.

The basic numbering plan also provides for the use of three additional digits, total 10, for future interconnection with foreign systems. In foreign interconnections, the first three digits will be the area code of the foreign system followed by the seven digit code just described as shown below in Table I.

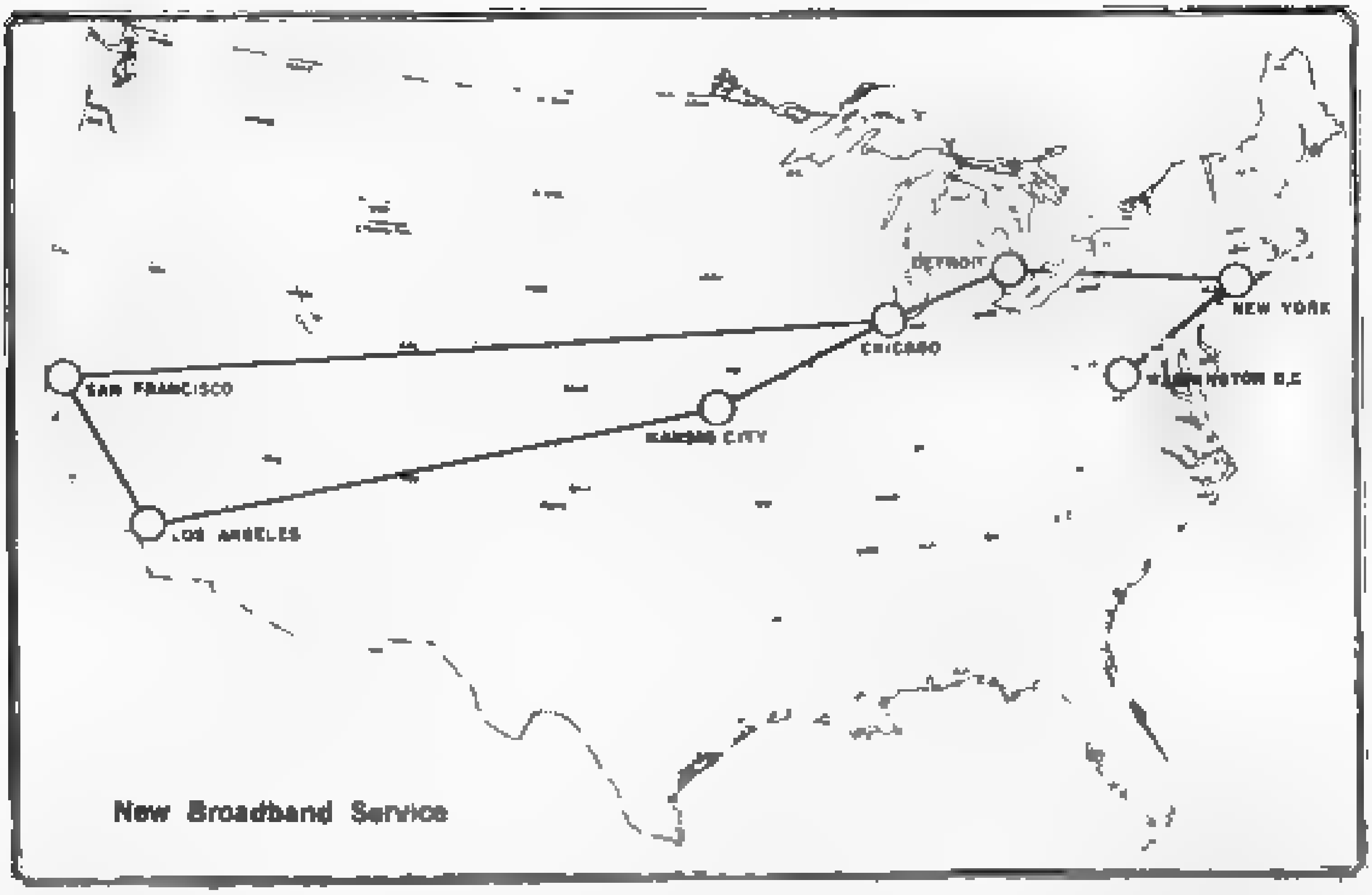
Table I

[illegible]-digit Address

YYY Foreign System Area Code	YYY Broadband Office Code	X Bandwidth Dial Number	 Bandwidth Band	XXX Called Subscriber Designation
YYY	YYY	0	Restricted	XXX
		1	not used	
		2	VF	
		3	not used	
		4	" "	
		5	" "	
		6	2 Kc	
		7	Reserved	
		8	Reserved	
		9	48 Kc	

YYY — designated code [illegible] by foreign systems

XXX — any digit, 0 to 9



New Broadband Service

Operation

To establish a DIAL-PAK* connection, the attendant removes the handset from the instrument and listens for the dial tone. When the tone sounds, the "voice" indicator on the instrument panel will glow The attendant then, by activating the push buttons in the desired sequence, initiates the call to the distant station.

Should the call be "voice only," for the purpose of coordinating later data transmissions or for the discussion of some related problem, the attendant may depress the numeral "2" or "6" as the fourth digit in the calling sequence. Since the fourth digit depressed selects the bandwidth to be utilized for that call, this results in either a Schedule I or Schedule II Broadband trunk being selected. Of course, if the numeral "9" is depressed as the fourth digit in the calling sequence, a DIAL-PAK* trunk will be obtained. Charges are calculated in keeping with the bandwidth utilized from call to ca

f, during the call sequence, two or more push buttons are depressed simultaneously a mutilated multifrequency tone will result In such an event, the call will either be terminated automatically or w l be routed to an intercept position which will, by use of a prerecorded announcement, request the caller to initiate a new call Likewise, should a subscriber attempt to call a non-existent number, a recorded announcement will inform the caller of the error

Assuming that the call is for voice coordination and high speed data transmission, the originating attendant will lift the handset, hear a dial tone, and thereafter depress the push buttons corresponding to the seven digits which identify the distant station. When the called station answers, voice coordination may take place. Also, as soon as the call is answered, high speed data may be transmitted simultaneously with the voice coordination. When the voice coordination has been completed, both parties place their handsets across the pod (or appendage) at the rear of the voice instrument This will cause the "data" light on the telephone to glow. Either party can lift his handset at any time, depress the ring button and thus re-establish voice contact At the conclusion of the data transmission, both parties hang up in the normal

* Western Union Trademark

As is the case with all Broadband subscribers, DIAL PAK* calls will be billed on the basis of a one-minute minimum with calls of longer duration billed in increments of 6 seconds. Thus subscribers will pay only for time utilized to the nearest 1/10th minute beyond the initial minute.

Automatic toll ticketing apparatus will be used to provide a record of the bandwidth utilized, the date and hour the call was answered by the called party, and the time the connection was terminated

Each DIAL-PAK* subscriber transmitting digital signals, will be supplied with a dataset by Western Union. (Analog transmissions will not require a dataset) The dataset will operate at 40,800 baud, synchronous, serially bit-by-bit This is a 16 to 20 times faster thruput than that offered on the narrower VF bands furnished with the Broadband Exchange service or on conventional voice grade dial-up services.

The switching apparatus as well as the circuits used for DIAL-PAK* are engineered in keeping with the customer's requirements for high speed data transmission. Each component of the system is carefully equalized and balanced to prevent detrimental noise, cross-talk and distortion. DIAL-PAK* will furnish the ultimate in service

Local loops employed to connect DIAL-PAK* subscribers to the local Western Union offices will be 8 wire loops. Four wires will be used for the voice instrument and sub-set control, while the other four will carry the high capacity 48kc signals. These local loops, like the switching equipment and trunk circuits, will be carefully engineered and balanced for the exacting requirements of 40,800 baud data transmission

Since DIAL PAK* is part of the Broadband Exchange family and will use common switching equipment; compatibility is assured for interconnection For example, a DIAL-PAK* subscriber may wish the 40,800 baud capacity in a number of locations while having a requirement for slower speeds, perhaps 2400 baud, at other locations. Two datasets, one 40,800 band and one 2400 baud will be required for the dual needs.

* Western Union Trademark

Alternate Service

From call-to-call, the service may be alternated between the 48kc service and 4kc service as desired. The only requirement being that the fourth digit in the calling sequence and the bandwidth utilized, not exceed the service subscribed to at either station. For example, a DIAL-PAK* subscriber may place or receive a call on a 48kc trunk or any lesser bandwidth for either data or voice use. A Schedule II Broadband subscriber can only call or be called on a 4kc or 2kc trunk while a Schedule I Broadband subscriber is limited to use of a 2kc trunk.

Should a subscriber attempt to call a higher bandwidth than that subscribed to, a recorded announcement will call attention to the error and request that the call be placed correctly

Optional Features

DIAL-PAK* also provides optional features, such as Automatic Answering Unit, extensions and full duplex service

Automatic Answering Unit

The Automatic Answering Unit (AAU) will allow direct, unsupervised interconnection with a computer, peripheral or a facsimile unit. As the selected interconnection is completed, the system will indicate to the caller that this has been done Another feature, the ACU (Automatic Calling Unit) will permit computers to originate calls. Data transfer between computers can be entirely automatic and under program control. This results in true automation, machine-to-machine, without human intervention

Subscribing to the AAU and ACU does not prevent the alternate use of the service for voice. Merely turning off the ACU makes it possible to initiate a call by use of the regular push-button calling procedure The called subscriber will answer automatically by means of the AAU; but the caller, by depressing the "ring" button on his instrument, can signal the called party to answer the call vocally

Extensions

Extension telephones will also be available to DIAL-PAK* subscribers. This permits a primary installation to be located near the computer and a second instrument in the office of the data center manager. This extension phone will prove to be a valuable convenience for discussion of operational matters with distant branches, for coordinating data handling, resolving procedural and programming matters, etc

DIAL-PAK* will be available initially in seven major cities: New York, Washington, Detroit, Chicago, Kansas City, San Francisco and Los Angeles. Subscribers located beyond the municipal limits of these cities may obtain DIAL-PAK service by subscribing to the extension service. Charges for extensions will be based on the air line mileage from the service location to the city limits of the municipality in which the DIAL PAK* switch is located

Full Duplex Service

The DIAL-PAK* service will be rendered on a full duplex basis end-to-end. When the dataset is employed, 40,800 bits may be transmitted in each direction simultaneously. This results in the transfer of about 600,000 8 bit characters, (300,000 in each direction) in a single minute. Or, if desired, the data stream may be sent in one direction with control signals traveling in the reverse direction. With duplex service, there is no loss of thru-put capability due to circuit "turnaround" time.

* Western Union Trademark

Since the voice coordinating channel is entirely separate from the 40,800 baud data path, two-way voice and two-way high speed data can be handled simultaneously If the voice channel is also equipped with a dataset, both low speed and high speed data transfer can take place at the same instant. Due to the duplex nature of the system, data may move in both directions and on both the low speed and high speed paths simultaneously.

Versatility

DIAL-PAK* subscribers will find many uses for the service and new economics in data transmission not heretofore avail- [redacted]

High speed data terminals for computers can converse with each other at rates up to 40,000 words per minute.

Centralized computer facilities installed at a home office can accommodate branch office data processing needs when high speed terminals are tied to the home office computer. Upon initiation by a branch office, for instance, payroll data can be sent to the computing center via magnetic tape or other suitable high speed devices.

Upon completion of the required processing cycle, home office personnel can contact respective branches and coordinate the transmission of processed payroll data, which can then be printed in check form, assuming the appropriate equipment is available. This arrangement can prove extremely advantageous to construction companies operating at numerous on-site locations, where delays in meeting payroll deadlines can result in heavy financial penalties.

Similarly, whenever large amounts of data must be transmitted between locations at regular intervals such as during financial reporting and inventory control periods, or order entry operations, DIAL-PAK* service results in a data telecommunications network offering high speed transmission capabilities at an economical cost.

Immediate solutions to scientific or business problems requiring computer processing are available to subscribers on a real-time dial up basis, even though remotely located from corporate data processing centers. Companies having multi-computer installations are able to balance their computer loads during periods of heavy usage. Whenever a particular computer's data handling capacity becomes over-taxed, a DIAL-PAK* circuit provides a temporary high speed error free channel to another computer, offering additional computation capability

Multi-edition newsmedia can be simultaneously printed, in both east and west coast editions, from edited text transmitted at high speed from a central editorial office to decentralized printing plants. Thus, magazine and newspaper publishers are able to meet deadlines with the latest news releases on a national scope

The nearly instantaneous transmission and reception of graphic data and written material by means of high speed facsimile transceivers becomes a practical reality when combined with the transmission capabilities of DIAL-PAK*.

* Western Union Trademark

Advantages

- High quality, high speed thru-put
- Costs geared to actual usage with a one-minute minimum — no need for costly full-period data channels
- Alternate use at voice-grade speeds
- Full-duplex capability.
- Simultaneous voice use/and 40,800 baud data transmission.
- Optional automatic answering units and automatic calling units permitting a high degree of automation.
- Standard "re-ring" feature
- Fast, convenient push button calling
- Only seven digits establishes a call
- Compatible with most business machines and computers. DIAL-PAK* can be interfaced with any known digital input/output device which operates at 40,800 baud, serially, bit by-bit

* * * *

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FRANCIS J. ALER, Program Director, BROADBAND Services in the Information Systems and Services Department, is responsible for the business development and marketing of BROADBAND

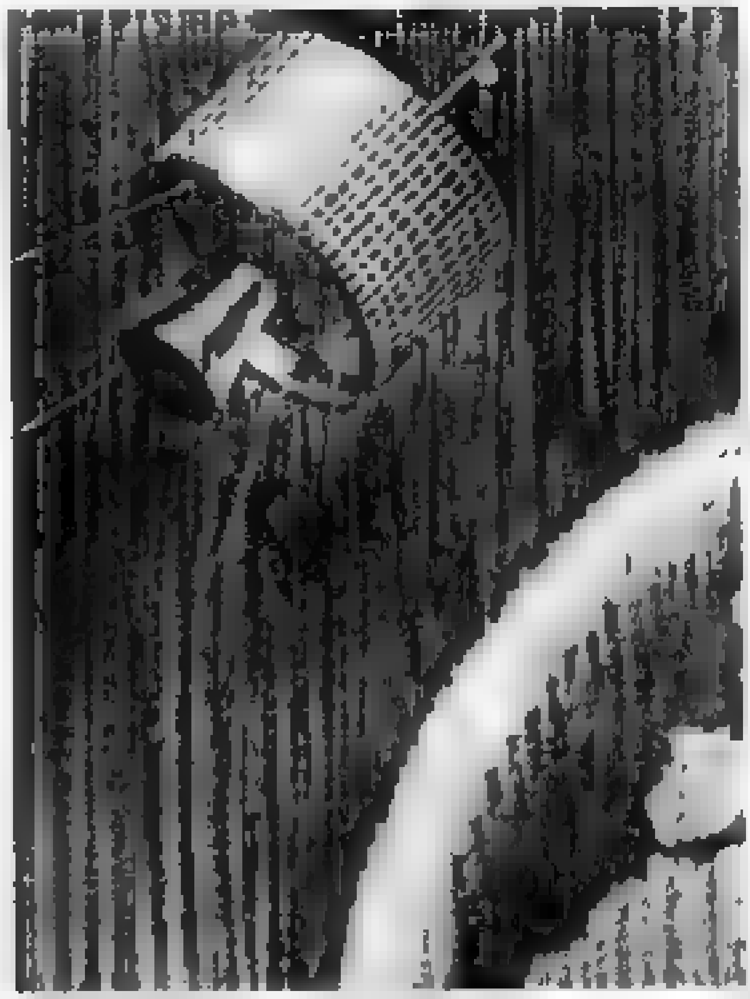
Mr. Aler first joined Western Union in 1937 and was concerned with the management of several of the Public Services offices in the Mid-West.

Since 1958 he has been active in marketing at the corporate headquarters in the Public Services Department and presently in the Information Systems and Services Departments.

domestic satellite systems

a new communication service

W. B. Sulinger



(Courtesy of Communication Satellite Corp.

It has long been the objective of communication engineers to provide a fast and reliable means of transmitting information to every corner of the earth. Progress has been rapid over land areas where wire lines, cables and later microwave radio have been constructed, using repeaters to cover great distances and provide wide bandwidths. However, spanning the oceans has been dependent, for many years, upon relatively low speed cables which were used for telegraphy. High frequency radio and in the last decade repeatered submarine cables provided wider bandwidths which have been used for voice as well as telegraph. However, it was not until the advent of satellites that a truly global communication system was possible which could provide bandwidths for transmitting all types of information, including television, to any point on the globe.

The use of satellites for communications has been recognized for many years but the practical application had to await advances in long life component technology suitable for operation in the space environment as well as advances in launch capability. Rapid strides have been made since the passive ECHO I satellite was launched in 1960. This was followed by the active experimental satellites TELSTAR I and II, RELAY I and II, SYNCOM I, II, and III and then the commercial satellites EARLY BIRD and LANI BIRD. Succeeding generations of communication satellites will include many more technological improvements such as increased capacity, higher power and longer life.

System Characteristics

Like the international systems, the domestic communications systems will use satellites in earth synchronous orbit. Such a system may be considered as analogous to a two-hop microwave system about 50,000 miles in length, with a repeater at the mid point. This system can be designed and the satellite can be stationed to provide communication channels between any two points within the United States. Thus, performance becomes essentially independent of the distance along the surface of the earth and the channel costs are equal regardless of circuit length. Of course, it is necessary to distribute the circuits from the satellite earth stations to service points by terrestrial facilities. The performance and cost of these facilities must be included in the overall system.

Considering the technical requirements, the linearity of the repeater in the satellite is not particularly critical, since cross modulation can be held to within reasonable bounds for multi-channel message service with normal design precautions. Neither does a serious problem exist in delivering a signal of adequate strength to the receiver in the satellite, since the antenna size and transmitter power at the earth station are not unduly limited. The down link (satellite to the earth station) is subject to a restriction on the effective radiated power because of limitations in the size and weight of the spacecraft and because the signal-to-noise ratio on this path determines the overall system performance.

The down link received signal level into the earth station antenna is in the order of -160dbw or less. This does not include any margin for fading or maintenance. However, variations in received signal levels are much less than those on terrestrial paths, since the signals from the satellite travel only a relatively short distance through the earth's atmosphere, as compared with terrestrial microwave signals. Therefore, reflection and refraction, which cause large variations in signal level over a terrestrial path, are not important factors to be considered in determining the margin requirements on the down link. Generally, between 5 and 10db is considered an adequate allowance for precipitation, including the effect of antenna radomes, if any, and for maintenance.

Receiving equipment, used to operate with levels of -160dbw or less require the use of masers and parametric amplifiers to obtain the low noise levels required. It is convenient to express the overall receiving system performance as the ratio of antenna gain (G) to receiving system noise temperature (T). An antenna having a gain of 53db and a receiving system noise temperature of 160°K will provide a G/T ratio of about 31db which is satisfactory for message service. However, it is readily recognized that other combinations of Gain and Temperature which give this same value may be used by the system designer.

Multiple Access

The signal transmitted from the satellite may be received throughout the continental United States. This feature makes the system ideally suited for a one way service, such as a television, where the same information is to be transmitted to many locations. However, a communications common carrier must furnish two way service which, when provided via a satellite, requires that a network of earth stations have the capability of communicating with each other. The arrangement of earth stations which provide this capability is known as "Multiple Access."

There are several types of multiple access systems, some have advantages others have disadvantages. However, the purpose of this article is to outline briefly a multiple RF carrier approach for connecting several earth stations

Consider a satellite containing two transponders or repeaters each assigned a different RF channel frequency, so that simultaneous two way communication may be established between two earth stations by using one of the repeaters for one direction of transmission and the other for the transmission in the opposite direction. If a third earth station is added, then it will receive the transmission from the other two but in order to be able to transmit to them, a third RF channel frequency is needed. Assuming that the two transponders are not loaded to capacity and the bandwidth is available, then the new RF channel may be handled through one of them thus making simultaneous two way communication possible between all three of the earth stations with three up and three down RF frequencies. Each RF channel may be subdivided using frequency division multiplex in the normal manner to satisfy the circuit requirements between the three stations. A fourth earth station may be added using a fourth RF channel for transmitting and assigning two RF channels to each transponder in the satellite. The number of RF channels, which may be handled through one earth station transmitter and through one satellite transponder is determined by the linearity and the power per circuit available. Assuming equal performance is required on all circuits then the total number of circuits through one transponder must be reduced as the number of RF channels through the transponder is increased. If one RF channel has a capacity of 1200 nominal 4kHz circuits, then two RF channels through the same equipment will be limited to about 480 4kHz circuits each. Thus, as the number of earth stations increase additional satellite transponders are needed

It is technically possible to use one transponder for both television and message Depending on the number of message channels, the preferred arrangement for accomplishing this may be with larger earth station antennas, rather than higher transmitter power and/or lower noise receivers. The decision is made after weighing many factors such as the network configuration, growth requirements, operating problems, reliability and economics.

The transponders in the satellite, which are used with the multiple access arrangement outlined above, are of the so called "Quasi-Linear" type. In this design the transmitted power is directly proportioned to the received power. The signal from the earth station, which is in the 5925-6425MHz common carrier band, is amplified and converted directly to the transmitter frequency in the 3700-4200MHz common carrier band where it is further amplified and fed to the antenna Thus, if there is no input to the receiver there will be no output signal present at the transmitter. When two signals of equal power are received, the power transmitted will be equally divided between them

The earth stations with multiple RF channel access follow a conventional design. A separate 70MHz carrier is generated for each channel then modulated, converted to the RF frequency, amplified and then used to drive a power amplifier. The receiver uses a wideband low noise amplifier followed by a down converter to 70MHz where a demodulator recovers the baseband. The several RF channels may be selected by using multiple local oscillator frequencies to drive the down converters.

Interference Considerations

Satellite systems share the 3700-4200MHz and 5925-6425MHz frequency bands allocated for common carrier use with terrestrial microwave systems. Therefore, great care must be exercised in the location of earth stations to avoid mutual interference The earth station transmitter in the 6000MHz band usually generates

several kilowatts of power which is radiated from an antenna 40 feet to 85 feet or more in diameter. This is a powerful source of potential interference to terrestrial systems operating in this frequency band. The frequencies in the 4000MHz band received at the earth station from the satellite are subject to interference from terrestrial system transmitters sharing this band

In locating an earth station it is necessary to determine if a potential interference situation exists to and from all terrestrial stations within the coordination distance as defined by the FCC Rules and Regulations. The harmful level of interference is that determined by CCIR Recommendations 356 and 357, Geneva, 1963 and Document IV/1029-E and IV/1030 E, Oslo 1966. In order to determine the interference level it is necessary to predict the propagation loss for various modes of propagation. Considering that the coordination distance may be as great as 200 miles and the number of terrestrial stations a hundred or more, a computer is essential to the calculation.

Performance

The Western Union proposal for a domestic satellite network will be used as the basis for calculating the performance to be expected from a satellite system. As discussed earlier the down link is controlling and therefore will be used to determine the test tone to noise ratio in a 3 1kHz channel. It is assumed that:

Satellite ERP	+37dbw
Free Space Loss @ 4GHz	197db
Antenna Gain @ 4GHz	52.5db
Receiving System Noise Temperature	157°K

Then

Carrier Power Input to Receiver	−107.5dbw
Noise Power per Hz @ 157°K	−207 dbw

The rms frequency deviation (f) due to noise in the top baseband channel is

$$f = \frac{a_n f_c \sqrt{2\delta f_c}}{A_c} \qquad (1)$$

where f_c = baseband frequency of the top channel = 5 6MHz

δf_c = channel Bandwidth = 3 1kHz

a_n = effective noise voltage/Hz before detection

A_c = effective carrier voltage

Therefore from (1)

$f = 3\ 31\text{kHz}$

The noise power Pn, in dbm, at the zero level point is:

$$Pn = Ps + 20 \log \frac{f}{F} \qquad (2)$$

where:

Ps = 15 + 10 log N (composite signal level)

N = 1260 (no. of 3.1 kHz channels)

F = 3 5 MHz (RMS deviation by composite signal)

Therefore substituting in (2),

Pn = −44 6dbmo

Assuming an improvement of 4db due to pre-emphasis and a psophometric weighting factor of 2 7db, then the test tone to noise power ratio becomes.

$44.6 + 4 + 2\ 7 = 51\ 3\text{db}$

Using the same satellite system for television, the peak to peak signal to weighted noise power ratio is calculated as followed:

$$S/N = 3 \left(\frac{\Delta f}{f_b}\right)^2 \left(\frac{C}{N}\right)\left(\frac{WF}{2 f_b}\right) \qquad (3)$$

where

Δf = peak to peak deviation = 20 1MHz

f_b = effective noise bandwidth = 5MHz

WF = pre-emphasis and noise weighting factor = 10 9db

C/N = Carrier to noise ratio per Hz = 99 5db

Therefore from (3)

S/N = 57.3db

The performance as calculated above compares favorably with that obtained on transcontinental microwave circuits even after adding a factor for fading, maintenance and the facilities used to extend the circuits from the earth station to terminal cities. However, the effect of absolute delay time, which is in the order of 250 milliseconds for one direction of transmission, must be considered for some types of service. On two wire telephone circuits, for example, the echo becomes very objectionable for delay times much greater than this. Another possible difficulty has to do with the transmission efficiency of circuits used for data when error correction or block acknowledgement is required before the next block is transmitted. The problem becomes more acute as the baud rate increases. Several solutions have been proposed[2] such as transmitting blocks back to back with block acknowledgement, storage at the transmitter so that the blocks would be sent continuously until an error occurred and then have the transmitter go back and repeat from the bad block on or it could be arranged to retransmit only the block in error. The choice of a technique depends upon the overall system requirements and involves, trade offs between circuit efficiency, cost of storage and the cost of software.

Reliability

Reliability is a major consideration in the design of any communication system. The earth stations associated with satellite systems are equipped with redundant transmitters and receivers to minimize service interruptions due to component failures. More than one satellite and/or multiple transponder can be used for protection purposes and to meet traffic growth requirements. Of course standby power is included in the design of all stations. The satellite must use long life components which can withstand the launch, operate satisfactorily in space and provide arrangements which will assure service continuity during the two umbra periods each year. These occur during the spring and fall equinox, when the satellite is in the shadow of the earth for varying times up to a maximum of about 69 minutes per day over a 40 day period. Batteries are included in the space craft to provide continuous operation during these periods when the solar cells are in the shadow or two or more satellites are used with a capacity adequate to handle the load and spaced far enough apart so that they are not within the shadow simultaneously. The logistics of keeping the necessary back up satellite available and placing them in orbit so there is no circuit down time requires precise planning to hold the costs within bounds. There is always the possibility that the launch will not be successful and therefore spare satellites must be kept in readiness in the event of a failure. Not the least part of the problem is the availability of a launch vehicle and the schedule for its use which must be made through NASA.

Implementation

The technology is available for the successful operation of a domestic satellite system. Western Union is prepared to build such a network and has selected and applied for approval from the FCC to construct earth stations at five locations within the continental United States. Action is now awaiting policy decisions as to the conditions under which domestic satellite systems may be established.

* * *

References

1. Applications filed on November 7, 1966 with the Federal Communications Commission by the Western Union Telegraph Company for authority to construct satellite earth stations in Oregon, Arkansas, Colorado, Iowa, Alabama.
2. Unpublished Report, by R. G. DeWitt, Western Union Telegraph Company

Western Union Domestic Satellite System

WILLIAM B SULLINGER, Director Transmission Systems, in the Information Systems and Services Department is responsible for transmission engineering on all systems. He has played a major role in the engineering of the Transcontinental Radio Beam System, and has been concerned with the design and testing of microwave relay systems for message and television service.

Mr. Sullinger received his B.S. degree in Electrical Engineering from Virginia Polytechnic Institute. He is a Senior Member of the IEEE and a member of the Communications Technology Group

Computer
Telex
Communication Service

Hunt, John A.: ISCS: Information Service
Computer System

Western Union TECHNICAL REVIEW, Vol. 21, No. 2 (April 1967)
pp. 76 to 85

The Information Service Computer System is an extension of Western Union services. It makes available to most users of Telex a range of communication/information services through the use of a single terminal.

This article describes the system approach, message format, and the functions performed in the processing of a message.

SICOM
Shared Transmission
Computer Switching
Communication System

Hamill, Vincent and Brody, K. L.: SICOM*, Security Industry
Communication System

Western Union TECHNICAL REVIEW, Vol. 21, No. 2 (April 1967)
pp. 98 to 103

SICOM provides the service of shared transmission and computer directed switching for the Brokers Committee. This article indicates that additional offerings will be offered with this service and geared to specific needs of the brokerage firms.

The Phase Sicom System is composed of a multi-computer switching and processing center located in Mahwah, New Jersey, and a national communications network radiating from this center.

Sicom is designed to provide brokers with rapid accurate business control in a securities communication system. It reduces his problems of training, maintenance and system updating, thus guaranteeing him the advantage of the latest communication and information breakthrough.

Info-COM*
Communications Service
Data Communications Systems

Bechtold, Henry P.: Info-COM, Information Communications Service

Western Union TECHNICAL REVIEW, Vol. 21, No. 2 (April 1967)
pp. 86 to 96

The introduction of the Info-COM* service will provide private wire customers with a nationwide computer operated message/data communications service on a shared use basis. Info-COM is a network of many private systems, each allocated to a specific customer. This system is made possible thru the new Western Union low and high speed data communications network to central computer processing centers.

This article describes the Info-COM service offering, message formats and the key service features including the Network Control.

HOT/LINE Service
Voice Communication
Shared Transmission

Cowin, H. J.: HOT/LINE, A Unique Voice Service

Western Union TECHNICAL REVIEW, Vol. 21, No. 2 (April 1967)
pp. 104 to 107

The HOT/LINE program planning began 5 years ago under A. J. Connery, now retired. It offers private voice service between two fixed points, using 54-line concentrators and shared trunks, rather than fully dedicated channels, per user.

This article describes a prototype installed in June 1965 which proved the concept was economically sound. The program was formally introduced in January 1967 between New York City and Chicago.

Over 90 systems are now planned, linking 26 major cities by the end of 1968. The service is priced below comparable long distance service, enabling very broad market appeal and application for those voice communications users with a daily point-to-point requirement.

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SERVICE TO OUR READERS: As a service to our readers, articles will be abstracted so that a complete file may be kept for reference purposes.

DIAL-PAK*
Broadband Service
Data Transmission

Afer, Francis J.: DIAL-PAK*, New Broadband Service

Western Union TECHNICAL REVIEW, Vol. 21, No. 2 (April 1967)
pp. 108 to 113

DIAL-PAK is a new data transmission service offered over the BROADBAND Exchange network which will provide time-metered, dial-up circuits of 48kc bandwidth. This article describes the special features of the service, its operation and its use for transmission of analog or digital information. Selection of alternate bandwidths, optional equipment needed for unattended computer-to-computer operation, and other advantages of DIAL-PAK are described in detail in this article.

Communication Systems
Satellite

Sullinger, W. B.: Domestic Satellite Systems,
A New Communication Service

Western Union TECHNICAL REVIEW, Vol. 21, No. 2 (April 1967)
pp. 114 to 119

The characteristics of a system using satellites in earth synchronous orbit are described and some of the design parameters indicated. The performance of the message and television channels is calculated for the domestic system proposed by Western Union. A multiple access arrangement using multiple RF carriers which permits simultaneous communications between a number of earth stations is outlined. The references used for determining the level of harmful interference to and from terrestrial microwave systems operating in the same frequency bands are included. The use of redundancy and batteries in the satellite to furnish power during the umbra period are among the features which contribute to the reliability of the system.

The Editor
TECHNICAL REVIEW
Western Union
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I am interested in a copy of your 20 yr. Index of articles which have appeared in the Western Union TECHNICAL REVIEW over the past 20 years.

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Our Readers Ask Top Management

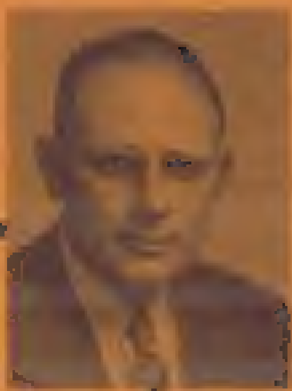
The following questions have been asked by our readers in view of the new developments in Information Systems and Services.

Q. WHY DID WESTERN UNION DEVELOP SICOM?

A. FROM EARLY IN WESTERN UNION'S HISTORY WE HAVE PROVIDED SERVICES TO THE SECURITIES OR FINANCIAL COMMUNITY. THESE SERVICES FIRST STARTED AS MORSE QUOTATION CIRCUITS AND GREW TO MESSAGE SWITCHING AND VOICE SYSTEMS WHICH HAVE EVOLVED INTO SOPHISTICATED COMPUTER COMPLEXES. FOR THE FIRST TIME IN WESTERN UNION'S HISTORY WE ARE DEVELOPING A SYSTEM DEDICATED TO A SPECIFIC INDUSTRY. THE SYSTEM, SICOM, A SHARED COMPUTER/COMMUNICATIONS COMPLEX, WILL PROVIDE BROKERAGE FIRMS WITH COMMUNICATIONS SERVICE FROM BRANCH OFFICES TO THE POINTS OF TRADING. IT WILL GIVE THE USER THE SAME CAPABILITY THAT HE WOULD HAVE WITH HIS OWN COMPUTER AT SUBSTANTIALLY LOWER COST AND WITH GREATER RELIABILITY.

M. H. JENNINGS

ASST. VICE PRESIDENT—INFORMATION, SYSTEMS AND SERVICES



Western Area

Q. WHAT GROUP OF CUSTOMERS IN YOUR AREA ARE INTERESTED IN HOT/LINE AND WHY?

A. THESE INDUSTRIES HAVE SHOWN KEEN INTEREST IN HOT/LINE:
TV AND RADIO STATION OWNERS, CLOTHIERS, ADVERTISERS, AND AUTO RENTALS. THE SERVICE HOLDS SPECIAL APPEAL FOR THE SECURITIES INDUSTRY WHICH IS A PRIME SUBSCRIBER. AS SPEED AND ECONOMY ARE IMPORTANT FACTORS, HOT/LINE IS A TOOL OF IMMENSE VALUE. IT WILL PROVIDE INSTANT POINT TO POINT COMMUNICATION AT THE LOWEST AVAILABLE COST. THE RATE STRUCTURE IS PARTICULARLY ATTRACTIVE AS IT ENSURES CHARGES WHICH ARE IN DIRECT RELATION TO THE ACTUAL AMOUNT OF CIRCUIT TIME USED AS OPPOSED TO THE TRADITIONAL THREE MINUTE MINIMUM.

R. D. SAYLOR
VICE PRESIDENT

Central Area

Q. WHAT WILL INFO-COM MEAN TO CUSTOMERS IN YOUR AREA?

A. THERE IS NO BETTER NOR MORE ECONOMICAL METHOD OF COMBINING COMPUTER TECHNOLOGY WITH COMMUNICATION REQUIREMENTS THAN INFO-COM SERVICE. TODAY, FAST, EFFICIENT, ECONOMICAL COMMUNICATION AND DATA PROCESSING IS A MUST FOR ANY SUCCESSFUL BUSINESS ORGANIZATION. THE COMMUNICATION AND DATA PROCESSING REQUIREMENTS OF AMERICAN BUSINESS HAVE DOUBLED IN THE LAST FEW YEARS. TO A LARGE EXTENT, THIS HAS BEEN CAUSED BY DECENTRALIZATION OF OPERATIONS. THERE IS HARDLY ANY TYPE OF MANUFACTURING WHERE THE ENTIRE OPERATION OF ADMINISTRATION, MANUFACTURE, AND SALES IS CONDUCTED AT ONE LOCATION. IT ALSO FOLLOWS THAT WHERE BRANCHES EXIST, THERE IS A REQUIREMENT FOR COMMUNICATIONS AND MORE PRECISELY INFO-COM SERVICE.

G. E. MULLINAX
VICE PRESIDENT

Eastern Area

Q. WHAT DO ALL THESE NEW SERVICES MEAN TO YOUR CUSTOMERS?

A. INFOCOM, BICOM, HOT/LINE, BROADBAND: ALL TERMS THAT ONLY A FEW SHORT MONTHS AGO WERE MEANINGLESS. BUT MODERN AMERICAN BUSINESS IS CONSTANTLY CHANGING AND WITH THIS CHANGE COMES CHANGES IN BUSINESS COMMUNICATION. IT IS THE FUNCTION OF THE COMMON CARRIER NOT ONLY TO MEET THE NEEDS OF AMERICAN BUSINESS AS THESE NEEDS DEVELOP BUT TO ANTICIPATE WHAT WILL BE REQUIRED. THIS IS OUR JOB. THIS IS WHAT WE ARE EVER STRIVING TO DO—TO CONTINUE TO BRING FORTH NEW METHODS OF COMMUNICATIONS, AND WITH EACH ADVANCE TO MEET NEW BUSINESS REQUIREMENTS.

E. C. CHAMBERLIN
VICE PRESIDENT

Our
New Idea
Factory

In this issue of TECHNICAL REVIEW, we have presented briefly the characteristics of some of the new systems and services which Western Union will provide to the business and industrial community this year.

For further information regarding Western Union Systems and Services contact:

Information Systems and Services
Marketing Department

Mahwah, New Jersey 07430

Telephone: 201-529-4600